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Digital Storm's Sandy Bridge-E box breaks Lab records!

**TESTED**
10 antivirus packages vie to protect your PC

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# inside

## HOLIDAY 2011




**On the Cover**
Illustration by Adam Benton

## FEATURES






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## IN THE LAB








MORE +



Gordon Mah Ung

# IT'S BEGINNING TO LOOK A LOT LIKE NERDMAS

**THE LEAVES HAVE FALLEN** from the trees. There's a chill in the air. And you just disinfected your coworker's computer: It must be Nerdmas!

And fortunately, this Nerdmas is looking like one of the best Nerdmas seasons in a long time. Since Nerdmas isn't a homologated holiday, nor one of the 367 holidays that bankers and Congress enjoy annually, there's some confusion over exactly when it starts. In our household it traditionally starts in late October, when you're forced to choose between a green Kirk costume or a gold Kirk costume. Perhaps this year, it's back to the basics with a Luke Skywalker *A New Hope* outfit.

From there, Nerdmas traditionally continues on through to the end of November when we sequester ourselves for four days to give thanks for PC gaming. This year, we'll be especially thankful for a plentiful crop that includes Battlefield 3, Batman: Arkam City, Rage, and even MW3.

Once Santa Claus stops by in a brown suit, though, it's time to stop gaming and begin enjoying the eight nights of hardware. That's traditionally the period when we install a new PC component every night. This year, will the MIB bring a Core i7-3960X, a Core i7-2700K, or an FX-8150? Perhaps it's Samsung's latest SSD, or a shiny new X79 motherboard, or 32GB of RAM? Maybe it's finally time to add that second GPU to make Battlefield 3 actually run with the Ultra setting.

By early December, the Nerdmas spirit of advising is in full swing. I normally put on a comfy pair of slippers, grab a glass of low-fat eggnog, put on a phone headset, sit down in my home office, and wait for the emails and phone calls to flow in from friends, family, and my wife's coworkers. Among the holiday advice warmly given: "No, you don't need 4G unless you have it in your area."

There's also: "For you, 8GB is too much; you can get by with 4GB. Put the money toward a better graphics card or bigger hard drive." And: "No, the Pentium G850 is not the same as the one you had in 1994. It's new." And: "Don't buy on megapixels, buy the camera that works for you." Or: "Yes, that's fine, but if you buy a Mac, I can't help you anymore."

But Nerdmas isn't all about gaming, PC building, and giving advice—it's also a time for family, friends, and rewatching the *Star Wars* and *Lord of the Rings* trilogies on Blu-ray. So for all the nerds out there, have a Merry Nmas!

*Gordon Mah Ung is Maximum PC's deputy editor, senior hardware expert, and all-around muckraker.*



↘ submit your questions to: comments@maximumpc.com

# THE NEWS

The 14.6-ounce, low-cost Kindle Fire doesn't skimp on quality, boasting a 7-inch LCD with 1024x600 resolution (169ppi), in-plane switching (IPS) for a wide viewing angle, and durable Gorilla Glass.




## Amazon Fans the Flames

### Kindle Fire reignites the tablet wars

**AFTER MORE THAN** half a year of one Android Honeycomb tablet announcement after another, it took a discounted, undersized, heavily modified pseudo-Android tablet to even approach the iPad 2 in terms of buzz and sales.

The appeal of the 7-inch Kindle Fire tablet certainly stems in part from its $199 price, for which Amazon takes a $10 bath per unit, if iSuppli's $209.31 build cost is accurate (Piper Jaffray estimates a $250 build cost). Most competing 7-inch tablets ring up at around $300.

However, it's not just money that contributed to the 250,000 Fire pre-orders in the first five days, which analysts expect to balloon to 3–5 million unit sales by the end of 2011. Amazon offers attractive features in the Fire that the company has been developing for years, not to mention an established and popular content delivery environment for books, music, and videos that a loyal customer base already enjoys. Among iPad competitors, only Amazon is uniquely positioned to treat its tablet like a game console: a hardware loss-leader for future content sales. Any e-books, music, or videos that a Fire user buys from Amazon will be stored for free in Amazon's Cloud Drive, lessening concerns over the tablet's relatively low 8GB onboard storage.

Beyond digital content, by giving Fire buyers a free one-month taste of Amazon Prime, Amazon is dangling the carrot of more than 11,000 commercial-free streaming movies and TV shows in front of Fire customers, anticipating a high conversion rate for the $79-a-year Prime service. Once those customers commit to Prime, they generally purchase many more physical goods from Amazon, as well, to take advantage of Prime's free two-day shipping.

So with one product, Amazon is undercutting its tablet competition and incentivizing its customers to purchase more digital and physical goods from its retail space. You add to that the new Silk mobile browser, which purports to increase web surfing speed by offloading some processing to the Amazon Web Services Cloud, and Whispersync for video as well as Kindle books, and we would not want to be in the 7-inch tablet business right now.

Because companies like Acer, Samsung, and Toshiba will not be able to match the Kindle Fire's price for their respective 7-inch Honeycomb tablets, they will have to market against the limited nature of the Fire. For one thing, the Fire is not full Android. Its heavily modified Android 2.3 UI is said to be more intuitive, but still severely limited. Case in point: It does not include access to the Android Market, and the Amazon Appstore pales in comparison, giving you neither the selection nor the quality of apps available.

Still, the unwashed masses of tablet users don't seem to be too turned off by closed, limited systems, if 29 million iPad users are any indication. Even Apple is rumored to be countering the Kindle Fire with a lower-cost iPad Mini in early 2012. Whether that happens or not, all tablet makers are now on notice that it took what is primarily a retailer—not an OEM—to throw a wrench in the engine of the iPad juggernaut. Now, arguably the top two tablet makers are also owners of a vast digital content sales and rental infrastructure. Good luck stepping to that, Samsungs of the world. **–MARKKUS ROVITO**




## Netflix Backpedals on Qwikster

When Netflix announced last September that it would be splitting off its DVD mail rental service into a separate business called Qwikster, CEO Reed Hastings said the change was made because "companies rarely die from moving too fast." In hindsight, he may regret that particular choice of words.

Netflix has announced it will not be spinning off its DVD business after all—the latest in a series of startling announcements by a company that seems to be moving just a little bit too fast. The change comes in response to an outpouring of anger over the proposed changes by Netflix subscribers, who were still smarting from July's price hike.

While the move has silenced some of the complaints from users who didn't want to use two services to manage their rental queue, it has done little to placate investors; Netflix stock remains at less than a third of its pre-price-hike value.

Irate customers aren't Netflix' only headache. In September the company announced that its deal with Starz will be expiring, meaning the company will lose a substantial portion of the Hollywood movies currently available for on-demand streaming. Add in mounting pressure from streaming rivals like Amazon and Apple, and you've got a major problem for the service. It's clear that Netflix will have to move fast to maintain its dominant position in the field—the question is whether it will be able to avoid further Qwikster-esque missteps. **–AC**

## Chrome Bags a Firefox

A report by StatCounter suggests that Google Chrome will unseat Firefox by the end of 2011 for the worldwide number-two slot in the cutthroat browser wars. Going by StatCounter's numbers, Firefox's October 2011 market share stood at 26.8 percent, while Chrome clocked in at 23.6 percent. Assuming usage trends continue, Chrome should surpass its rival in December.

However, data from Net Applications looks very different, with Chrome claiming 15.5 percent of usage and Firefox having 22.6 percent. Both metrics firms show Chrome rapidly gaining ground, while users slowly slip away from Firefox and IE. Even with Net Applications' numbers, if current trends continue, Chrome should surpass Firefox by mid-2012. **–BC**

## Eight Nations Ratify ACTA

In October, eight countries signed the Anti-Counterfeiting Trade Agreement (ACTA). Australia, Canada, Japan, Morocco, New Zealand, Singapore, South Korea, and the United States inked the deal, while the remaining participants—Mexico, Switzerland, and the European Union—pledged to sign at a later date.

ACTA backers praise it as a cooperative international fight against intellectual property (IP) theft, while its detractors blast it as a heavy-handed attempt to shove U.S. IP law, like the DMCA, down other countries' throats. Stipulations of ACTA include the outlawing of devices that circumvent copyright, extensive seizure of counterfeited goods, and undefined monetary rewards for victims of counterfeiting. ACTA will establish its own governing body outside of any current international institution. **–MR**



Tom Halfhill
**Fast Forward**

## UNDERCLOCKING TO SAVE ENERGY

**NOT MANY OF US** could convince our bosses that we're most efficient when working slowly. But then, we aren't microprocessors. For decades, researchers have known that processors achieve peak energy efficiency when their transistors operate at very low voltages near the threshold between their on and off states. Unfortunately, the circuits also become unstable at those low voltages. Nevertheless, Intel is trying to apply that research to future products.

The technology is called near-threshold voltage (NTV) computing. In effect, it's extreme *underclocking*. PC users are more familiar with overclocking—cranking up the processor's clock frequency and/or voltage to squeeze out more performance. Although overclocking works, it consumes more power—a small price to pay when we're hungry for speed.

However, the price isn't always small. Big data centers are sometimes limited by the electrical grid's local capacity, and their cooling often gobbles more power than the servers do. At the other end of the spectrum, mobile devices must save energy to lengthen battery life and keep from becoming too hot to handle.

Today's processors can't operate much below 1.0V. Intel has an experimental x86 processor (Claremont) rumored to work at 0.6–0.7V. Although that difference may seem tiny, it's actually huge. Intel says the chip remains fully active (not in sleep mode) while sipping less than 10 milliwatts—low enough to run on a small solar cell.

The sacrifice is raw performance. Clock speed drops dramatically, but power efficiency (performance per watt) is five times higher. When more performance is needed, boosting the voltage drives the processor to its full clock speed.

Future processors could run some or all CPU cores at NTV levels most of the time. Stabilizing the circuits requires fine-tuning, though. With its own fabs, Intel has a potential advantage over competitors that outsource manufacturing to independent foundries.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.



Thomas McDonald
**Game Theory**

# SATAN'S COPY PROTECTION SCHEME?

**MY DECEMBER COLUMN** defending Diablo III's always-on DRM generated as much hostility as anything I wrote since I called Doom III a hollow, clichéd piece of garbage. The responses were a mixture of insults and reasonable commentary (mostly insults), with complaints falling into three categories.

First, I totally exaggerated piracy losses, and it's really no big deal. Of course! Companies always spend millions of dollars and risk consumer anger on irritating and expensive loss-prevention schemes so they can prevent imaginary theft.

Second, I didn't mention mods. The argument here is that Blizzard is doing the DRM this way because it wants to hose the mod community. I actually didn't mention mods because I truly *don't care*. Mods are a nice bonus, but if Blizzard doesn't want it modded, that's its privilege. If Blizzard wants to lock down its products so all downloadable content must be purchased through it, that's probably because it'll make more money that way, which is what a business does.

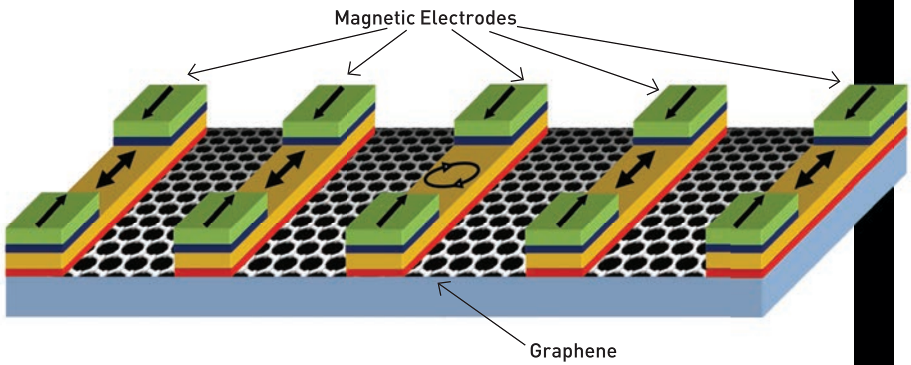
Third, I totally was bought off by Blizzard. (I wish.)

Yes, I know I am fortunate, and that some people have bad (or no) Internet connections. They're already missing out on all kinds of great things like cute puppy videos and Ashton Kutcher's Twitter feed, so they must be accustomed to the poignant sting of disappointment by now.

Since first writing about Diablo III, I've put several hours into the beta, and my main complaint about the new system is the lack of local saves for single-player games. If that makes it to the final release, it will definitely lower my opinion of the product.

The odd thing about defending Diablo III is that I never really liked the games that much. As an old-school RPG fan, I find them too simplistic for my tastes. Naturally, if Bobby Kotick wants to send me a big check, then I'm sure I will suddenly *love* them.

Thomas L. McDonald can be found online at stateofplayblog.com




## Physicists Try to Reinvent Electronic Computing

Talk about a monumental task. Roland Kawakami, a professor of physics and astronomy at the University of California, Riverside, is leading a multi-campus research team on a project aimed at replacing conventional silicon electronics with a new way of computing that's better equipped to process large-scale applications. The team's budget: a $1.85 million grant awarded for winning the national Nanoelectronics for 2020 and Beyond competition.

Kawakami believes conventional silicon electronics can only go so far before the technology hits a wall. His team is looking to fully integrate the functions of logic and memory in a single chip. It starts with developing a new type of building block called a magnetologic gate (pictured) to serve as the basis for the technology, in the same way transistors are the backbone of conventional electronics. The gate is made of graphene with a bunch of magnetic electrodes that store data, while electrons move through the graphene to use the spin state to store and process information. **–PL**

## Sprint Adopts 4G LTE for 2012

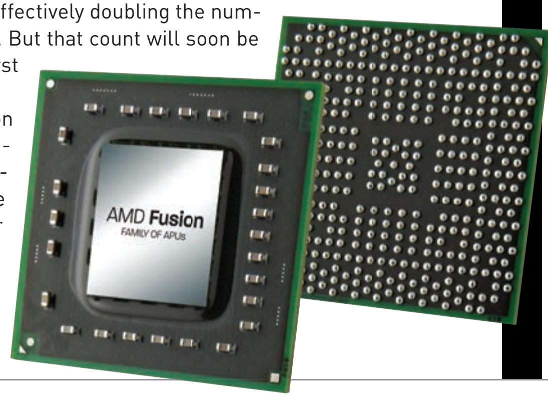
It may be the RC Cola of cellular carriers, but Sprint still brings some refreshment to the wireless scene. After stubbornly hanging on to unlimited 3G data plans for the iPhone 4GS, Sprint announced a full-scale shift from 4G WiMax to 4G LTE beginning in 2012. Its first LTE device should drop midsummer of 2012, with a total of 15 devices to come by the end of the year.

That rollout will cover 120 markets and 120 million people, with the transition scheduled to blanket 260 markets and 250 million people by the end of 2013. Some 2012 Sprint hotspots will access both WiMax and LTE networks. **–MR**

## AMD Discontinues First E-Series APUs

In August 2011, AMD launched a couple of dual-core E-series accelerated processing units (APUs), the E-450 and E-300, effectively doubling the number of E-series APUs on the market. But that count will soon be halved as AMD plans to retire the first two chips in the lineup.

Fudzilla reports that AMD will soon stop taking orders for the 1.5GHz single-core E-240 and the 1.6GHz dual-core E-350. Both of the chips were among the first AMD APUs. Neither will be available for order by the end of 2011, and their shipments will cease by the end of Q2 2012. **–PC**





Quinn Norton
**Byte Rights**

# KILLING OFF INNOVATION

**I'M JUST GOING** to be blunt: Our patent system sucks. It's terrible to deal with, protects ridiculous things, and encourages frivolous litigation. It's about as popular as a leper in a nudist colony.

For 10 years, patent reform has had the backing of major corporations who, like everyone else, are sick of patent trolls and costly defensive IP purchases. Nobody—not consumer groups, business, or inventors—believes this system works. Despite all of this, Congress managed to punt on real change. "It took 10 years to work out a deal that changed almost nothing," says Jason Schultz, director of the Samuelson Law Clinic at UC Berkeley, speaking about the America Invents Act (AIA), the reform that finally crawled its way into law this year.

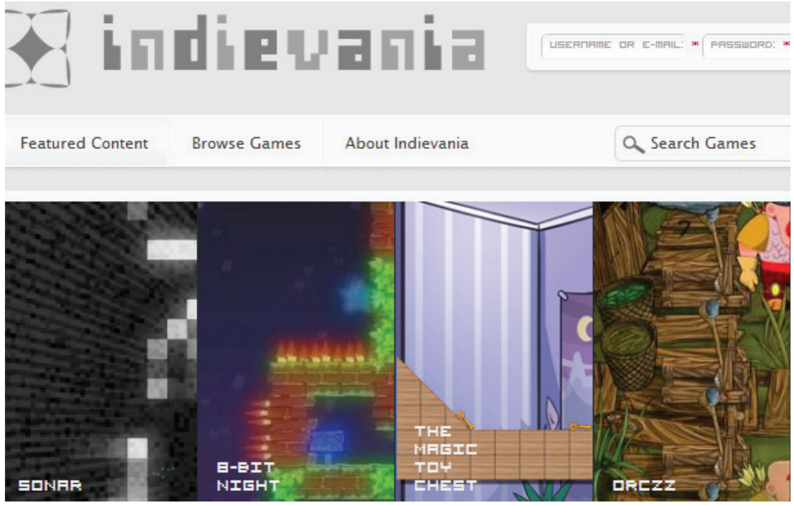
The administration claimed it to be a job creation bill, which is true, if your job is patent attorney. "[The idea] that patents create jobs is ridiculous," says Schultz. "There's growing evidence that too many patents actually hurts the economy."

The AIA demonstrates how profoundly broken American legislation is. It makes small procedural changes, like awarding patents to the first to file or disclose, instead of the first to invent (which can be hard to establish legally). That won't prevent patent litigation, but it may make it go more smoothly—like treating a broken leg with Vicodin.

AIA does nothing to hamper notorious patent trolls like Nathan Myhrvold's Intellectual Ventures. It doesn't address the low quality of many patents, the snail's pace of the patent office, or the ultimate problem: There's just too many of them being filed.

Instead, look for more patent fights putting new technologies out of business, limiting existing technologies, and diverting billions of dollars from people who actually build stuff to people who file paperwork, and then spend the next 50 years collecting interest and playing golf. Thanks, Congress!

Quinn Norton writes about copyright for Wired News and other publications.




## Indievania Opens the Floodgates to Games

Alientrap Games, the team behind the Steam über-hit Capsized, has created a new distribution site for indie titles, where all profits go directly to developers. With no app to download, the website currently supports PC, Mac, and Linux games, and is expected to feature various Android titles.

In the Android tradition, Indievania has no screening process, letting developers release what they want, when they want. The service even allows developers to sell unfinished games in hopes of funding more development.

Indievania is currently in beta, but has secured major titles like Blocks That Matter and Cthulhu Saves the World, both of which are available on Steam, as well. **–AF**

## Net Neutrality Laws Met with Lawsuits

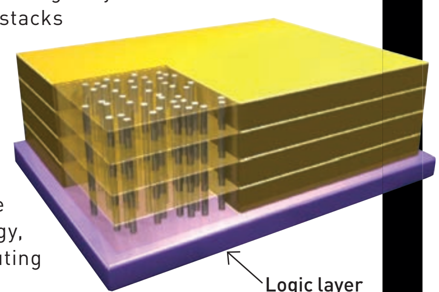
Nearly a year after first being proposed, the FCC's Net Neutrality rules, which govern how broadband providers operate, become law on November 20, 2012. In a nutshell, the rules require ISPs to disclose their network management practices and restricts them from discriminately blocking web content. But no sooner had the rules been printed in the Federal Register than opponents to them began filing suit. First to court was Free Press, a consumer activist group that objects to how the antidiscrimination policies are more lenient for wireless providers than they are for wired operators. Then Verizon, one of the largest wireless ISPs, filed a suit claiming the FCC doesn't have authority to impose *any* regulations on the Internet. These suits, and undoubtedly others, represent a debate that's been waged since the concept of net neutrality first surfaced, and which looks poised to continue in the courts. **–KS**

## Hybrid Memory Cube to Replace DDR3 DRAM?

Samsung, Micron Technology, Altera, and others have formed the Hybrid Memory Cube Consortium to design and promote specifications for the brand-spankin' new Hybrid Memory Cube (HMC) memory technology making the rounds. The consortium says the technology can one-up traditional DDR3 DRAM in multiple areas.

HMC uses high-speed logic processes built on a logic layer with several DRAM dies laid atop it to create cube-like stacks of memory that can supposedly deliver "15 times the performance of a DDR3 module" while simultaneously "utilizing 70 percent less energy per bit than DDR3 DRAM," according to Hybridmemorycube.org. Micron teamed with Intel to create the technology.

"The industry consortium will help drive the fastest possible adoption of the technology, resulting in... radical improvements to computing systems," says Micron VP Robert Feurle. **–BC**



# THE LIST

## 8 INNOVATIVE NOTEBOOK CONCEPTS



### 8 ONE LAPTOP PER CHILD INITIATIVE, 2007

A popular initiative to provide simple and cheap computers for kids spawned $200 notebooks that featured full-fledged keyboards and 10-inch screens.




### 7 BENTLEY EXCLUSIVE, 2008

Luxury car maker Bentley released 250 of these handmade, leather-bound laptops. The price of such lavishness? $20,000!

### 6 LENOVO THINKPAD W700ds, 2008

This 11-pound laptop featured a 17-inch display along with a 10.5-inch slide out display—an ideal mobile workstation for graphic designers and video editors.





### 5 ACER ICONIA 6120, 2010

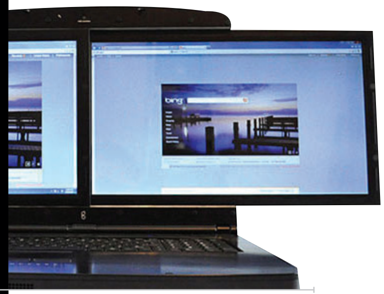
With Acer's dual 14-inch touch screens, you can use one screen as a virtual keyboard while you work on the other.

### 4 DELL DUO, 2010

The Duo's screen can swivel in its docking station when the keyboard isn't needed, or be removed altogether for use as a tablet.



### 3 gSCREEN SPACEBOOK, 2011



Slated for a November release, the Spacebook offers dual slide-out 17-inch screens. The 10-pound beast sports a magnesium-alloy frame to cut weight.

### 2 ASUS WAVEFACE LIGHT, CONCEPT

Part of a concept series of e-toys featuring flexible, bendable materials, the Waveface Light can be flattened for use as a tablet.




### 1 MICROSOFT COURIER, CONCEPT

MS had the Interwebs abuzz with its "secret" two-screen tablet in a book form factor. Sadly, it never saw the light of day.



# HEAD TO HEAD

BY BRAD CHACOS

# Spotify vs. Rdio

At first glance, Spotify and Rdio could be mirror images of one another. Both streaming services offer a catalog of on-demand songs from all the major music labels, both feature strong social media integration, and heck, each offers two tiers of premium subscriptions at matching dollar amounts. Dig down beneath the surface, however, and you'll see that the devil's in the details. So which Internet music service delivers the most bang for your buck? Let's dive in and see!

### Round 1: Music Selection

When it comes right down to it, the most important aspect of a streaming music service is the songs it offers. As we mentioned previously, both Rdio and Spotify enjoy song catalogs buoyed by participation from the major U.S. music labels, but one definitely outshines the other. Rdio features a 12 million-song catalog, while Spotify tops that with a 15 million-title library that includes almost everything you can think of—and it's adding thousands more on a daily basis. Plus, a lot of Spotify's tracks come from indie labels, which could sway many on-the-fence listeners.

**Winner: Spotify**

### Round 2: Pricing

Both services offer a similar structure for their premium content: The $5 plan unlocks unlimited, ad-free streaming, while moving to the $10 version opens up device support. The difference lies in their free plans. Rdio's free model is ad-free, but limited to an unspecified number of tunes; Rdio wants users to treat it as a sampling rather than a free service. Spotify, on the other hand, recently announced that new users will get six months of unlimited free tunes in exchange for listening to a handful of ads; after the six-month mark, you'll be limited to 10 free hours every month.

**Winner: Spotify**

### Round 3: Flexibility

The similarities between Rdio and Spotify continue on the flexibility front. Both offer support for most of the major mobile phone operating systems. Spotify supports Symbian, while Rdio supports Blackberry. Both let you play music around the house on your Sonos system or a handful of other home audio devices, but to be honest, each service lacks the sheer device support of, say, Pandora or Slacker. Then there are the sign-up woes: Rdio's limited free option may keep some folks away, while Spotify requires new users to have a Facebook account in order to sign up.

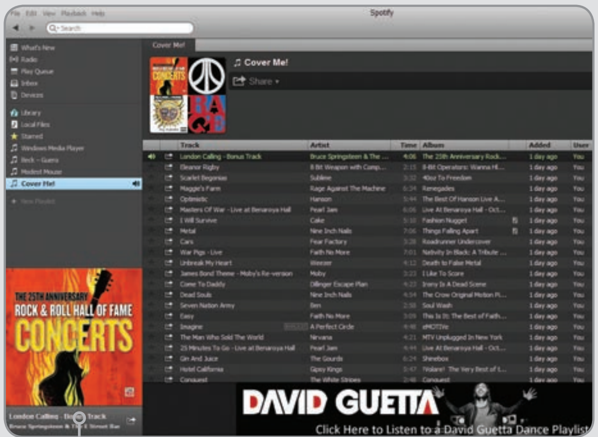
**Winner: Tie**

### Round 4: Audio Quality

Making a call on audio quality is made more difficult by Rdio's refusal to settle on a solid number: All the company will say is that it's constantly tweaking the bitrate to achieve the best experience for listeners. Spotify's audio quality is more concrete. It streams songs at 160Kb/s through the desktop client and either 160Kb/s or a lower-bandwidth 96Kb/s (user's choice) on mobile clients. The bitrate goes up to 320Kb/s with a Premium subscription or for those listening over a Sonos player. If you toss aside the numbers and actually listen to the two services, however, Rdio sounds much more crisp and clear.

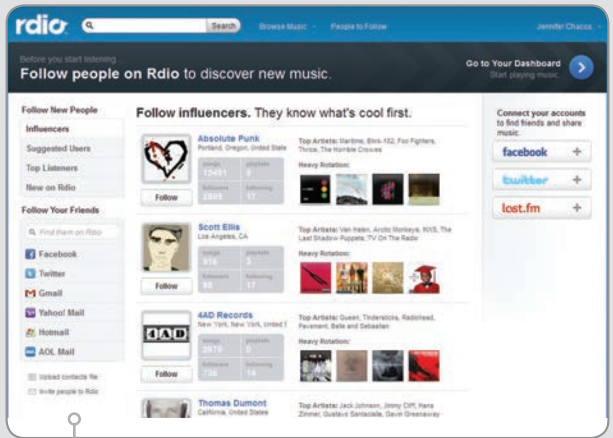
**Winner: Rdio**

# HEAD




**SPOTIFY**

**Spotify's interface resembles Windows Media Player's or iTunes', but the free version includes advertisements.**




**RDIO**

**New users are greeted by Rdio's social media features, rather than Rdio's song catalog.**

### Round 5: Social Features

Rdio asks you to start following other Rdio users, "influencers," or your friends on Facebook, Twitter, Last.fm, or email before it even shows you a single track, and its dashboard shows recent activity that any Rdio subscriber has made. Plus, Rdio's group playlist collaboration is awesome. Spotify gives users the ability to quickly and easily share playlists and songs on Facebook, Twitter, and Windows Messenger by simply right-clicking a track, and the service allows you to create HTTP and Spotify links that open specific tracks when they're clicked. Both services can fully integrate with Facebook's Open Graph.

**Winner: Tie**

## And the Winner Is...

Rdio does a lot of things right; its desktop client features some of the best sounding tunes out there, and its social media integration is second to none and tied with only one. Unfortunately, that one is the one that matters in this particular contest: **Spotify**. While both services offer only average device support, Spotify's gargantuan 15 million-track song library—the biggest of any streaming music service—gives it the lead over Rdio, and its free, ad-supported plan delivers the knockout blow. Both services have their strong points, but when it comes down to spending your hard-earned dollars, Spotify gets the nod.

# DOCTOR

THIS MONTH THE DOCTOR TACKLES...

## >Upgrade Decisions
## >Bonus RAM
## >DIY Hybrid Drive

### Upgrade vs. New Build

I'm stumped over whether I should upgrade my existing system or just get (build) a new one. My system is a Dell Inspiron 537 bought in August 2009, with a 2.5GHz Pentium E5200, 3GB of DDR2/800, a 320GB hard drive, a less-than-decent videocard, and Windows 7 Home Premium. My system does not lag in web browsing, but I noticed that even HD video is laggy (GPU does not support H.264 decoding), and that tells me it won't do well everywhere else. Your Dream Machine 2007 should beat my PC, even with less RAM. But forget the rants, is it worth upgrading? If so, then what can/should I upgrade for less than $60? Or if not, then what parts can I get for less than $800? Should I wait for Ivy Bridge or build now?

**—Neel Chauhan**

**THE DOCTOR RESPONDS:** It's pretty iffy on that box. According to some Inspiron 537 users, the board in that box (with the latest BIOS) will support up to a 2.66GHz Core 2 Quad Q8400 processor. That gets you more cache over your 2.5GHz Pentium E5200 and two processing cores. The problem is, used Core 2 Quad Q8400s go for $150 to $200, which just isn't worth it considering how cheap faster processors are. If your concern is H.264 decoding, you should consider upgrading to a GPU that supports it. Even basic cards such as the GeForce GT 520 should suffice, and they're available for as low as $35 with a rebate. That should help you get by at least until Ivy Bridge comes out and you can do a new build.

### Reuse or Recycle?

My parent's computer stopped turning on recently, and they gave it to me. It has a 3GHz Pentium 4 processor on an Intel D915GEV board with 2GB DDR2 RAM, a 350W PSU, some GeForce card from 2005, a 2TB hard drive (which I'll keep), and Windows XP. Are any of these parts worth reusing? I'm planning a gaming computer/server.

**—Big Doug**

**THE DOCTOR RESPONDS:** If you're planning a gaming computer, about the only thing you can salvage from that build is the hard drive. If you want to build a server, that box looks like a pretty good candidate for a FreeNAS build, provided you can get it working again without spending much money. The usual tactic applies: If you have spare parts handy, swap out the parts on the rig one by one until it works. Since your parents' computer stopped turning on, we'd guess it's the power supply, which is a very common failure point. If you have a spare one hanging around, try using that to see if you can get the computer to power on again. If that doesn't work, you may want to grab a good flashlight and check out the capacitors on the board. If any are bulged out like a balloon, the caps likely failed. The vintage of the machine may make it a victim of the bad caps that plagued most electronics of that era. You should also double-check both the main power connector and the ATX12V connector, reseat the videocard and RAM, and also reset the BIOS by pulling the coin cell from the unit for a few minutes while the machine is unplugged from the wall.

### DIY Hybrid Drive?

I want to build a system with an SSD such as the OCZ Vertex 3. I know that if you put two in RAID you can get some fast speeds, but what if you use an SSD and a normal hard drive in a RAID config? Will you still get the increased speed or will the normal hard drive slow everything down? I can't seem to find a decent answer to this.

**—Mike**

**THE DOCTOR RESPONDS:** It's best (and we mean all other options are extremely inadvisable, if they're possible at all) to only RAID matched drives. This means drives of not only the same capacity, but the same make and model, as well, unless of course you're using a JBOD (just a bunch of disks) array. In which case, yes, the normal hard drive will slow everything down. So the short answer is you can't RAID an SSD and a mechanical drive, and you shouldn't, even if you could. What you should do is use the SSD for your OS, as well as whatever apps you want to be very, very fast, and use the mechanical drive for everything else: games, media, and backups of your SSD.

If you have a motherboard with a Z68 chipset, however, you can use Intel's Smart Response Technology. That uses up to 64GB of your SSD as a cache for your mechanical system drive, which will speed up your system without you having to micromanage what goes where. Otherwise, we recommend following the advice of The Offspring: You gotta keep 'em separated!

### Static Still a Problem?

I was recently watching a YouTube video posted by a custom PC builder. He was doing an unboxing session of his customer's parts, including a pair of GTX 590s. As he held up the cards to the camera, he grabbed the PCI connectors several times with his bare fingers and showed little regard for the sensitivity of the components (not to mention the price).

↘ submit your questions to: doctor@maximumpc.com

I posted a comment saying I'd be upset if I were the customer and saw him touching the circuit board and contacts with bare hands. People replied saying it doesn't matter, there's no risk, and that I was completely wrong.

I've been building computers for 15 years and am always very careful about what I touch and even wear latex gloves when working with sensitive components. Am I just totally old-fashioned? Is it really not a risk anymore? Even if it's just a low risk, these are $700-plus graphic cards! Seems to me that those PCI contacts are a highway for static straight to the core of the GPU. Please enlighten me.

**—Drew Bierlein**

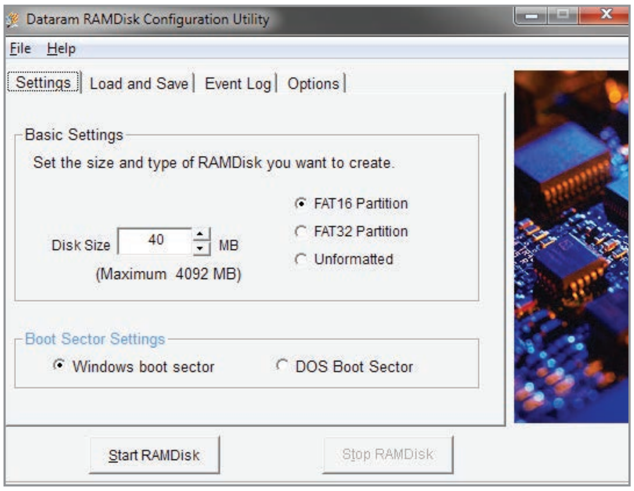
**THE DOCTOR RESPONDS:** Oh, for the days when electronic components were thought to be so sensitive that looking at them too hard with your X-ray vision could hurt them. Not that the Doc wasn't in this camp. He used to don a blue ESD smock religiously when working with electronic components, but these days, the smock never sees action. We've all been trained to believe that electronic components are delicate flowers, but the Doc has witnessed incredible feats, such as a CPU placed in the socket rotated incorrectly 90 degrees, sparklers attached to a CPU, and both RAM and a GPU removed while a system was fully powered on—all without damage to the hardware. That doesn't mean you should actually try to induce damage, but the Doc has come to believe that the antistatic strap isn't necessary for the typical consumer building a PC. ESD precautions should certainly be taken on a production line, but unless it's one of those high-static days or you just pulled a load of socks out of the dryer, you're probably fine just touching something metallic before you do any tinkering on a box.

## Rampant RAM

I have a Core i7-870 with a GTX 460 (768 MB) and 8GB of RAM. I noticed today that Newegg is offering the same RAM modules I have for $35. I know that memory price tends to fluctuate through cycles, and the price usually hits a low point before slowly rising again as new memory replaces older modules and the older memory becomes scarce due to low production. I snatched up the memory because I don't expect to see prices like this again. But will I ever benefit from the extra memory? I built my computer for gaming (Portal 2, Episode 3).

**—Leslie Young**

**THE DOCTOR RESPONDS:** You are unlikely to actually see an increase in performance in any games by upgrading to 16GB, as few games will actually take advantage of that much RAM. You're only likely to see a performance increase when editing huge digital image files or running several applications simultaneously that suck up the RAM. That doesn't mean it's all a waste. You could set up a small RAM disk that will put even the fastest SSD to shame. DataRAM's RAMDisk (memory.dataram.com) will let you create up to a 4GB RAM disk for free.




**Put excess RAM to work as a virtual disk drive with DataRAM's RAMDisk software. It's freeware that allows you to create RAM disks up to 4GB, or for $15, to unlock larger capacities.**

## Stream Videos to Android

I have an HTPC (Windows 7), a WHS server, and a MyTouch 4G Android phone. I'm wondering if there is any easy way to stream a DVD to my phone (or a tablet, preferably Android) without a laborious conversion first? Ripping to disk with something like DVDFab Decrypter is pretty fast. But conversion with HandBrake is too slow; it takes about 1x the length of the movie for me. Is there anything out there? I have been looking at Air Playit, but that does not seem to have an Android app yet.

**—Bob A.**

**THE DOCTOR RESPONDS:** Correct you are, Bob. The Air Playit Android app is still labeled as "coming soon," so that may take longer than a whole shelf of HandBrake DVD conversions. However, there are a number of ways to skin this cat, which you can peruse through a quick search of popular Android forums. The method the doctor prescribes is called Emit (www.emitapp.com). This allows live streaming from a PC/Linux/Mac computer running the free Emit desktop app to an Android or iOS device running the Emit app. You can use it over your phone's data connection or Wi-Fi, and you can add servers' IP addresses to the list of shared directories. Grab Emit ($3.54) or the ad-supported Emit Free from the Android Market.

**[SECOND OPINION]**

# OEM LICENSE DENIED!

In the September 2011 issue, there was a question titled "Mobo Swap Causes Instability." The user had installed Windows 7 Pro OEM version and then proceeded to upgrade his motherboard. As such, he invalidated his software license per the Windows 7 Pro OEM end-user license agreement once he replaced the system motherboard. You are allowed to replace a defective motherboard with the same model, but not to upgrade to a different brand or model. You advised him to call the Microsoft activation hotline to get a new activation code, but he should not assume they will provide him another code under those circumstances. If users want to move Windows licenses with them as they upgrade components, they should purchase the retail version of Windows so they have portability rights. OEM software is not to be sold into the general channel, but since it is, customers need to know the licensing restrictions that accompany it. For verification of Microsoft OEM licensing, check the FAQ at bit.ly/cYB9kH.

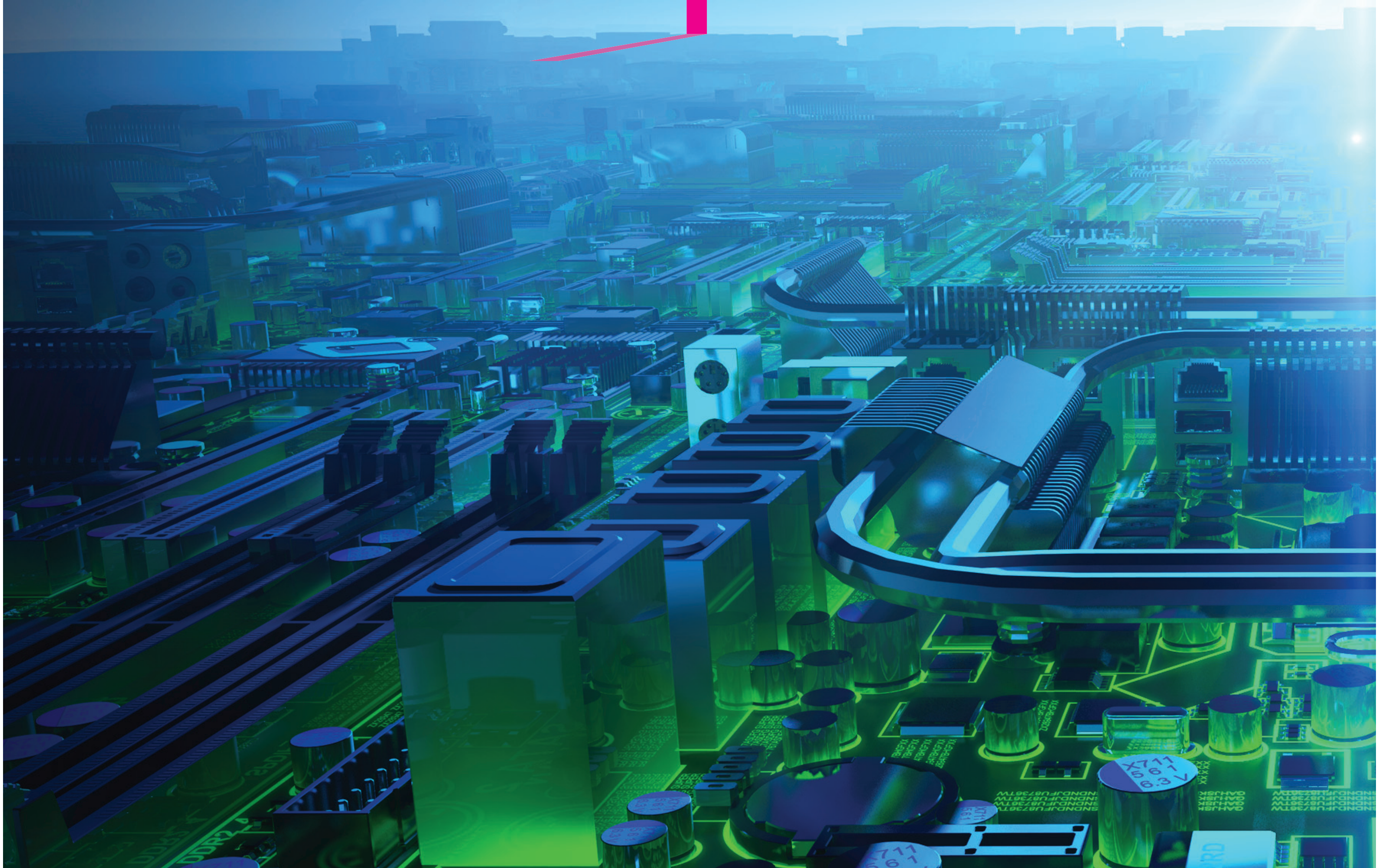
**–Mark H.**

**THE DOCTOR RESPONDS:** That is true, and the Doctor has said numerous times that the OEM copies of Win7 are generally tied to the motherboard and that you may not be able to activate after a board swap. However, many people have reported that Microsoft has granted activations with new motherboards without issue, and Microsoft's own position on this contradicts itself.

# THE FUTURE IS BRIGHT

MAXIMUM PC'S 2012 TECH PREVIEW

BY THE MAXIMUM PC STAFF AND LOYD CASE



**FORGET EVERYTHING YOU'VE HEARD ABOUT THE PC BEING DEAD.** The onslaught of smartphones, tablets, and sundry cloud-based devices might give us ways to be "connected" in more places at more times, but they don't lessen the wonders to behold in a full-fledged PC. Not by a long shot.

In fact, despite all the dire prognostications about the PC, our personal computers are poised to get a major boost in performance, thanks to all the new technologies and components coming to fruition next year. We're going to give you the complete rundown on what to expect—can someone say *fastest CPU ever*?—so you can start plotting your next build now.

Oh, we'll still see plenty of tablets, to be sure, and we'll tell you how those happening slabs will change, but we're also going to see a major push by Intel to make stylish, super-portable, super-affordable laptop PCs an even more compelling option.

Yes, there's a lot to look forward to in 2012. And you can start peeping at what lies ahead by turning the page!



# INTEL SANDY BRIDGE-E

## WELCOME TO THE FUTURE OF PERFORMANCE COMPUTING



Intel's Sandy Bridge-E blends the best of both worlds: It has the core and thread count of a Core i7-990X Gulftown proc and the core performance of a Core i7-2600K Sandy Bridge.

**TRUE PERFORMANCE ENTHUSIASTS** have had a very difficult choice this past year. Go for maximum core and thread count using an older core microarchitecture, or cheap out and get almost the same (or better) performance in most apps and games using the mainstream Sandy Bridge chip.

That, in a nutshell, has been the enthusiasts' dilemma ever since Intel introduced the Sandy Bridge chip in January 2011. Well those days are behind us now that Intel has finally, finally released its Sandy Bridge-E (for Enthusiast) chip. With one simple chip—the new 3.3GHz Core i7-3960X—Intel has neatly folded up all those worries and put them into a nice little blue box stamped with the Intel logo.

### A TRUE ENTHUSIASTS' CPU

Boiled down to the simplest of terms, if the quad-core 3.4GHz Core i7-2600K (or its new sibling the 3.5GHz Core i7-2700K) was the best chip out there, the Core i7-3960X is now the bestest. That's because the Core i7-3960X is simply a Core i7-2600K with two additional cores.

Actually, that's not really accurate. As an enthusiast chip, there are no graphics cores in the Core i7-3960X. And while the Core i7-2600K is limited to just 16 PCIe 2.0 lanes, the Core i7-3960X sports 40. Even better, those 40 lanes of PCIe support are PCIe 3.0 compliant. Out the gate, however, Intel (or its lawyers, anyway) is reluctant to label them as PCIe 3.0 until it actually has enough PCIe 3.0 cards to test.

As to the cores, you already know about them. They're Sandy Bridge cores and include AVX and AES-NI instruction-set goodness. Turbo Boost 2.0 on these models will take the top-end 3.3GHz Core i7-3960X to 3.9GHz. The cores are built using Intel's 32nm process and, well, there are two more of them turned on.

Besides the added cores, enthusiasts will also be thrilled by the memory support: To keep those cores fed, Intel is using a new quad-channel memory controller. The memory controller seems significantly faster than previous iterations, too. While the tri-channel memory controller in the original LGA1366 didn't blow our socks off (over a dual-channel configuration), the quad-channel controller in the Core i7-3960X has us stunned. In our tests, we found that it offered nearly 100 percent more memory bandwidth than the Core i7-990X's triple-channel configuration.

### PSSST, IT'S REALLY EIGHT CORES INSIDE

Intel isn't making the Core i7-3960X just to satiate the appetites of speed freaks. The chip is mostly intended to be sold as a Xeon workstation CPU. So it shouldn't surprise you that the Core i7-3960X is actually an eight-core chip. Yup, that's right; looking at the block map of the chip, you can see that the new CPU has two sections blocked out where cores seven and eight go. Why leave them off? Intel officially says the decision was based on its desire to balance clock speeds, thermals, and power needs. We suspect that it's really because Intel doesn't need those two extra cores at this point. Not to telegraph too much, but AMD hasn't posed much performance competition yet. By leaving cores off now, Intel can always introduce octo-core chips later if it needs to be more competitive. There could also truly be a thermal concern, as unsubstantiated rumors (are there any other kind?) initially told of Intel's new chip pushing an unheard-of 180-watt thermal rating.

Yeah, we know what you're thinking already, because we asked the same thing ourselves: Can you unlock those two other cores?

Negative, Ghostrider. Intel has laser-cut those cores off in the die, so unless someone has the smallest-possible soldering gun, we'd bet a box of adamantium claws that it's impossible.

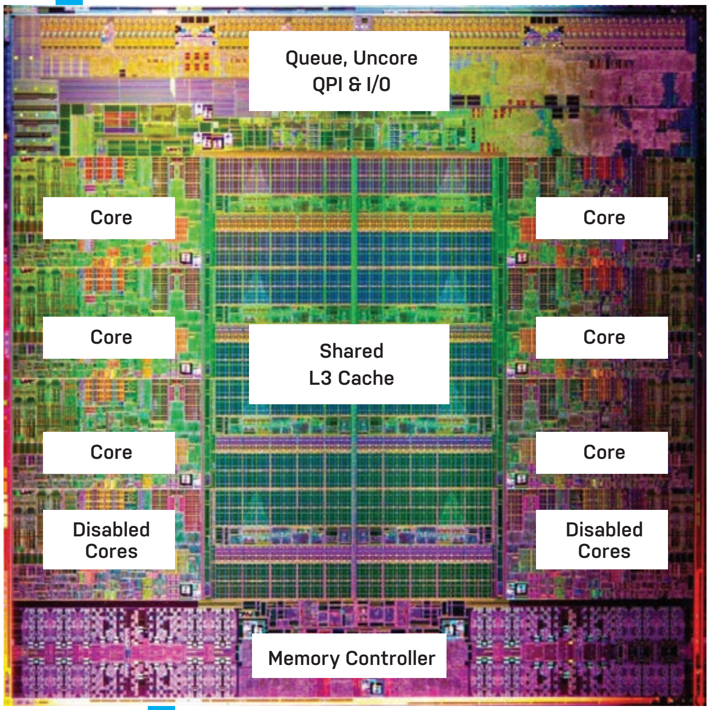
#### MEET THE NEW PLATFORM

As is Intel's modus operandi, the company has a new socket. While the switch from LGA1156 to LGA1155 certainly pissed off customers, the LGA1366 crowd can hardly complain. LGA1366 launched with the original Core i7-965 Extreme Edition way back in 2008. For Intel to even support a socket that long is almost unheard of. So, with Core i7-3960X, Intel is introducing its new LGA2011.

Why the extra pins? The additional pins in the socket are to support the quad-channel memory and the relocation of the PCIe lanes from the core-logic chipset to the CPU core (à la Sandy Bridge and Lynnfield). For the most part, enthusiasts will be tickled pink with the beastly new socket, the quad-channel memory, and PCIe 3.0. What they won't be happy with is the SATA 6Gb/s situation. The new X79 chipset features a Serial Attached SCSI controller that can support up to 10 drives in SATA 6Gb/s, but at the 11th hour, the feature was switched off due to compatibility concerns. Instead, we're left with an X79 peripheral controller hub that's pretty much a weak-sauce retread of the P67 and Z68's PCH: two SATA 6Gb/s and four SATA 3Gb/s ports. You can certainly argue that you don't need more than two SATA 6Gb/s ports since they're only useful for SSD drives, but we think it stinks, especially as we had been teased by thoughts of motherboards bursting with SATA 6Gb/s. We expect initial boards to be limited in SATA 6Gb/s ports due to the last-minute switch, but in a few months, board vendors will tack on additional ports using third-party controllers. If anything, the SATA 6Gb/s features on boards and how they're implemented will separate the men from the boys in mobo land.

#### MEET THE SANDY BRIDGE-E FAMILY

For the LGA2011 platform, Intel is introducing three new chips: The top-end Core 7-3960X at $990—yup, that's $9 cheaper than the existing Core i7-990X chip (gee thanks, Intel!) that this Extreme chip is meant to replace. Intel is also introducing two other chips. The mid-tier 3.2GHz Core i7-3930K will sell for $555. Besides the lower stock clock, the chip will shed some of the L3 cache, for a total of 12MB. For the budget enthusiast,




**Don't rub your eyes: There really are eight cores on that monstrous 32nm die. And no, you can't unlock the bottom two, except in your wildest dreams.**

Intel has plans to release a quad-core, Hyper-Threaded Sandy Bridge-E with 10MB of L3 cache early next year. Prices of the Core i7-3820 haven't been released, but we're pretty sure it'll slot in at about $300. The part is "partially unlocked," meaning it will have limited overclocking features, and is likely intended as a way to get entry-level enthusiasts in the X79 game.

The good news for enthusiasts is that Intel has no plans to step away from offering blistering-fast chips with cutting-edge technology, despite all the focus on tablets and smartphones these days. Hallelujah.

**TOP CHIPS COMPARED**

| | INTEL CORE I7-2600K | INTEL CORE I7-990X | INTEL CORE I7-3960X | AMD PHENOM II X6 1100T | AMD FX-8150 |
|---|---|---|---|---|---|
| **Clock** | 3.4GHz | 3.46GHz | 3.3GHz | 3.3GHz | 3.6GHz |
| **Turbo Clock (max)** | 3.8GHz | 3.7GHz | 3.9GHz | 3.7GHz | 3.9GHz (4.2GHz) |
| **TDP** | 95 watts | 130 watts | 130 watts | 125 watts | 125 watts |
| **Cores / Threads** | 4 / 8 | 6 / 12 | 6 / 12 | 6 | 8 |
| **Volume Pricing** | $317 | $999 | $990 | $205 | $245 |
| **Process** | 32nm | 32nm | 32nm | 45nm | 32nm |
| **Total L2 Cache** | 1MB | 1.5MB | 1.5MB | 3MB | 8MB |
| **Total L3 Cache** | 8MB | 12MB | 15MB | 6MB | 8MB |
| **Die Size** | 216mm$^2$ | 240mm$^2$ | 435mm$^2$ | 346mm$^2$ | 315mm$^2$ |
| **Transistor Count** | 995 million | 1.17 billion | 2.27 billion | 904 billion | 2 billion |
| **Socket** | LGA1155 | LGA1366 | LGA22011 | Socket AM3 | Socket AM3+ |
| **Memory Controller** | Dual-channel DDR3/1333 | Tri-channel DDR3/1066 | Quad-channel DDR3/1600 | Dual-channel DDR3/1333 | Dual-channel DDR3/1866 |

# AMD BULLDOZER

## AMD FINALLY CATCHES UP, SORT OF

**AMD'S NEWEST CPU** is perhaps the worst-kept secret in the industry. It seems like years ago that the company telegraphed the microarchitecture and garnered much attention. That's no surprise, as the chip code-named Bulldozer is considered AMD's first true CPU redesign since the original Athlon 64. Truth be told, there's also a lot hanging on the new chip, as many are wondering if AMD still has the mojo to go toe-to-toe with Intel's processors.

### JUST WHAT IS A CORE?

The last year has seen a blurring of the lines regarding the definition of a core. Is it strictly x86? Do you count the integrated graphics portions? Adding to that Jack Daniel's blurred-and-slurred line is AMD's new Bulldozer. Officially named FX (in a throwback to the glory days of the Athlon 64 FX-51), the chip makes you wonder if what you thought was a core is still a core.

FX isn't made up of cores, but rather modules. Each module is built using two monolithic "cores." Each core has its own set of integer schedulers, pipelines, and L1 data cache. AMD says that compared to Intel's Hyper-Threading, which splits up the resources of a single core into two virtual cores, FX's design won't get as bogged down when it has to deal with multithreaded workloads. On an Intel chip with Hyper-Threading, the core really only has resources for one core, and multithreaded loads must take turns running if the code calls on the same portion of the chip. That's not the case with FX.

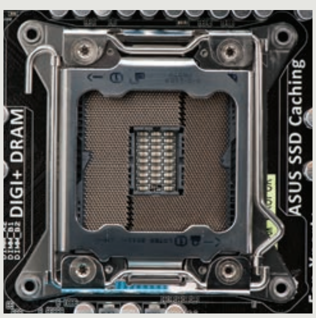
But AMD didn't completely duplicate all the resources of a dual core in its module—a single floating-point unit services both of the cores in integer workloads. Why just integer workloads? AMD says it believes that's where most of the performance is to be made today.

AMD also says the modular design lends itself to higher performance when, say, a single-threaded workload is thrown at a single module. That's because the cores are so interconnected that if only one core is working, some of the second core's resources can be put toward that single-threaded workload.

AMD will launch four FX chips (two eight-core, one six-core, and a quad-core) ranging from $115 to $245. The company's top-end part is the FX-8150, which is made up of four dual-core modules on a single die. One potential performance issue AMD has already admitted could crop up on Windows 7 and older OSes is the scheduler inefficiencies. The scheduler should know to throw four threads at four different modules, instead of four cores on two modules for the highest performance. Unfortunately, Windows 7 and anything older isn't capable of determining how to load an FX for the utmost performance returns, AMD says. That may not happen until Windows 8 is released. Intel faced similar teething pains when Hyper-Threading was first released.

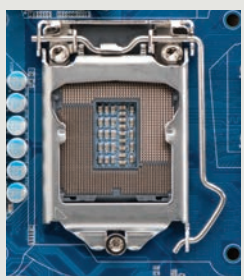
## LET'S TALK SOCKETS

A to-scale comparison of LGA2011, LGA1155, and AM3+



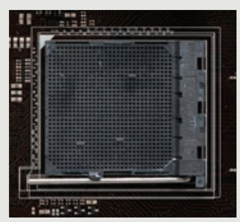

**LGA2011**

**Yes, Intel's new LGA2011 is really *that* huge and even has two arms to lock it down. It has to be big, given all the memory channels and PCIe lanes it must support.**



**LGA1155**

**Surprisingly, Intel will stick with the LGA1155 socket through at least the new Ivy Bridge chipset next year instead of pushing it overboard.**



**AM3+**

**AMD's new AM3+ socket really just adds beefed-up voltage guidelines for board makers, so many late-model AM3 boards may work with the FX CPU.**




The FX is the first consumer eight-core CPU, and may even work in some AM3 boards with the proper BIOS.

**NEW MAX TURBO AND NEW INSTRUCTIONS**

AMD first introduced Turbo modes with its hexa-core Thuban chips, aka Phenom II X6. With FX, the company has refined its Turbo even more with a new Max Turbo mode that, well, maxes out the overclock. On workloads that hit all cores, each one can be overclocked by 300MHz, to 3.9GHz. On lightly threaded workloads, half of the cores can go to sleep while the other half can clock up to 4.2GHz.

Elsewhere in the chip, AMD has brought the new CPU to instruction parity with Intel. The FX processors will have AES instructions to support acceleration of encryption and decryption workloads, and Advanced Vector Extensions (AVX), which Intel introduced with its Sandy Bridge lineup, is now also present. The old instruction-set wars still run hot, though, as the FX will support the Fused Multiply Add 4, or FMA4, instruction set. Intel, unfortunately, is only supporting FMA3 in its upcoming Ivy Bridge CPUs and has apparently canceled plans to support FMA4. This little standoff could cause problems with developers as to which instruction set they support and how they support it. Who is at fault? Most observers say both companies are playing games. Our standard guidance is to not sweat over new instruction sets, because by the time software support is there, the first chips to support it are usually so old that it's just easier to upgrade instead.

**NEW CHIP, SAME OLD SOCKET**

There's one thing AMD gets right year after year—the same old socket. While Intel has shuffled through five sockets, AMD has pretty much stuck with just one. The only change has been to the electrical underpinnings in the AM3+ spec, which could render some AM3 boards incompatible. Still, it's expected that the AM3+ FX chips will drop into most late-model AM3 boards without incident (check with your motherboard vendor first, of course) and even better, the mounts for the coolers have remained the same, so you can reuse your exotic cooler.

In a nod to enthusiasts, AMD says all FX chips will be fully unlocked, giving overclockers an all-access backstage pass to faster speeds. With Intel's chips, only the K versions and Extreme Editions are fully unlocked. AMD has made overclocking a bragging point, too, and helped fund a team of overclockers to push an FX to 8.429GHz using liquid helium.

So where does Bulldozer stand? On paper, it looks like AMD has finally caught up—to some of Intel's Sandy Bridge chips, anyway. But what does it look like in benchmarks? For the answer to that, you'll have to read on.

## TRINITY AND BEYOND

### AMD continues down the APU path

**AMD'S E-350**, aka Zacate, was the sleeper hit of the year and completely sold out several times. The company's second Fusion part, Llano, is also forecast to sell well, with some reports saying the chip will equal 40 percent of AMD's total sales.

The message? While AMD has been unable to outdo Intel in the performance category for some time, its APU approach to the mainstream seems to be gaining traction. Next year, AMD will introduce a new CPU-*cum*-GPU, code-named Trinity, which it hopes will continue that trend.

The top-end Trinity will use a derivative of the FX core modules to create an eight-core chip with a new DirectX 11 GPU. Like FX, the chip will be fabbed on a 32nm process by Global Foundries. What's unfortunate is that AMD may pull an Intel and switch to a new socket called FM2, and it's not clear whether Trinity will be compatible with existing FM1 motherboards.

Despite the excitement over Trinity, AMD won't be giving up on the high end. The company has a very ambitious plan to increase the performance of FX chips over the next few years. In 2012, the company expects to release Piledriver. The year after that we'll see Steamroller, and the year after that Excavator.

Each iteration is expected to bring at least a 10–15 percent performance increase, the company says. AMD won't say what the microarchitecture changes are exactly, but that most of the performance should come from clock-speed bumps and other changes under the hood.

## IVY BRIDGE COMETH

### Bringing a 22nm process, 3D transistors, and more

**INTEL HAS A REPUTATION** as the master of the process, and that likely won't change early next year when the company introduces its new Ivy Bridge chip. The most significant aspect of Ivy Bridge is the move to a new 22nm process using 3D transistors. These transistors literally use three dimensions, and if Intel's bet pays off, could offer very significant power reductions and higher performance dividends on CPUs. Ivy Bridge itself is only considered a "tick," Intel speak for small step forward. That's describing the x86 side of the chip, which won't offer huge changes. On the GPU side, Intel says it will introduce a major step forward in graphics performance and add DirectX 11 and support for OpenCL. Ivy Bridge chips will also offer the ability for OEMs to dial thermal performance up or down (it's not known if end users can change this yet).

Ivy Bridge will also bring new FMA3 instructions, a new digital random number generator to enhance security, and improved power management. Also on tap is support for PCIe 3.0.

The really good news is that Ivy Bridge will be backward compatible with current LGA1155 motherboards. PCIe 3.0 won't be supported in all slots on all boards (although some vendors say they're ready to go with PCIe 3.0) and will require a BIOS update to run. Paired with Ivy Bridge will be the new Panther Point, or 7-series, chipset that will finally bring native USB 3.0 to Intel CPUs.

# BENCHMARKAPALOOZA

## WONDERING IF A QUAD-CORE CAN BEAT AN OCTO-CORE? OR IF ALL HEXA-CORES ARE ALIKE? PEEP THE NUMBERS

**FOR OUR TESTING**, we built four machines to test the various chips and tried to balance them as closely as possible. Each test station had a stock-clocked GeForce GTX 580, the same public Nvidia drivers, 64-bit Windows 7 Professional, and matching WD Raptor drives. Why not SSDs? We've seen occasional SSD performance variance among chipsets, leading us to believe that an HDD is the more reliable option for comparison. (We have, however, tested several of our benchmarks with current-gen SSDs to ensure they weren't being bottlenecked by disk I/O). One area where our configs diverged was in RAM, due to the channel differences. The dual-channel and quad-channel systems featured 8GB of DDR3/1600, while the tri-channel had 6GB of DDR3/1600. The difference is very unlikely to impact our benchmarks, as none cross the 6GB boundary.

For the Phenom II and FX-8150, we used an Asus Crosshair V Formula motherboard. With the FX-8150, we used a specific UEFI developed by Asus for testing, while a public UEFI was used with the Phenom II X6. The Core i7-2700K was tested with a Gigabyte GA-Z68X-UD3H-B3 board, the Core i7-990X with an Intel DX58SO2 Smackover 2 board, and the Core i7-3960X blew away everyone from the socket of a new Asus P9X79 Deluxe board.

And that's really the upshot of all this. In the Intel three-way showdown, we figured the Core 7-3960X would give us only a slight boost over the Core i7-990X. Instead, the newer hexa-core demolished its older sibling in just about every test. The 3960X really shined in multithreaded tests, with encoding taking 20 percent less time. Using Sony Vegas 10, we saw the 3960X kick out a 27 percent faster encode. 3D rendering saw increases from 13 to 27 percent. And that pesky Core i7-2600K, which occasionally beats the pricier 990X? The 3960X put it in its place in most of our tests or ran dead even with it. In actual per-core performance, Sandy Bridge and Sandy Bridge-E were about the same, but the extra cache, additional memory bandwidth, and four more threads make the 3960X not just a winner, but a decisive champ today. The Core i7-3960X is simply the fastest CPU we've ever tested and puts red meat back on the menu for PC enthusiasts.

That doesn't negate the value of the 2600K and new 2700K, though. Systems using those chips are far cheaper to build, offer more than enough performance, and have a solid upgrade path. So how do you pick? Generally, we're sticking to our recommendation that if you do 3D rendering, video editing, or other workstation tasks for a living, the 3960X is a must-have CPU. If you also find yourself encoding a lot of media, those extra cores are well worth it. However, if you primarily game and don't get paid by the hour to render video or perform other processing-intensive tasks that need the cores, the 2600K/2700K is still a killer value—for now. That's likely to change when Intel releases its quad-core version of the Sandy Bridge-E. If the part is price competitive, it might simply make more sense to build on that chip, which has a better upgrade path for an enthusiast.

And what about AMD? To be fair, we don't think the FX-8150 should be compared to the new 3960X or the 990X, as those chips cost four times as much. But what about the 2600K? Even there, the FX-8150 has a tough time and can get beaten pretty badly by Intel's second-fiddle Sandy Bridge. AMD actually thinks the eight-core FX-8150 is a better match with Intel's Core i5-2500/2500K parts (a 2600K with less cache and no Hyper-Threading). How meaningful that is really depends on how you view the

glass. In one way, it's great that AMD finally has a part that is at least competitive with some of Intel's higher-tier Sandy Bridge CPUs. But seen differently, how good is it that after all this time and a major redesign, the best AMD can do with an octo-core CPU is compete with a cheaper Intel quad-core chip? We know that for people who only pay attention to core counts (like they did megahertz), the sound of eight cores is really appealing. But with GPU and CPU cores starting to blur, does it really matter how many "cores" you have? Just as we once had to keep in mind that a 2.13GHz Athlon XP could kick the crap out of a Pentium 4 clocked 1GHz faster, perhaps we have to stop looking at CPUs in terms of cores but instead look at, well, the model number.

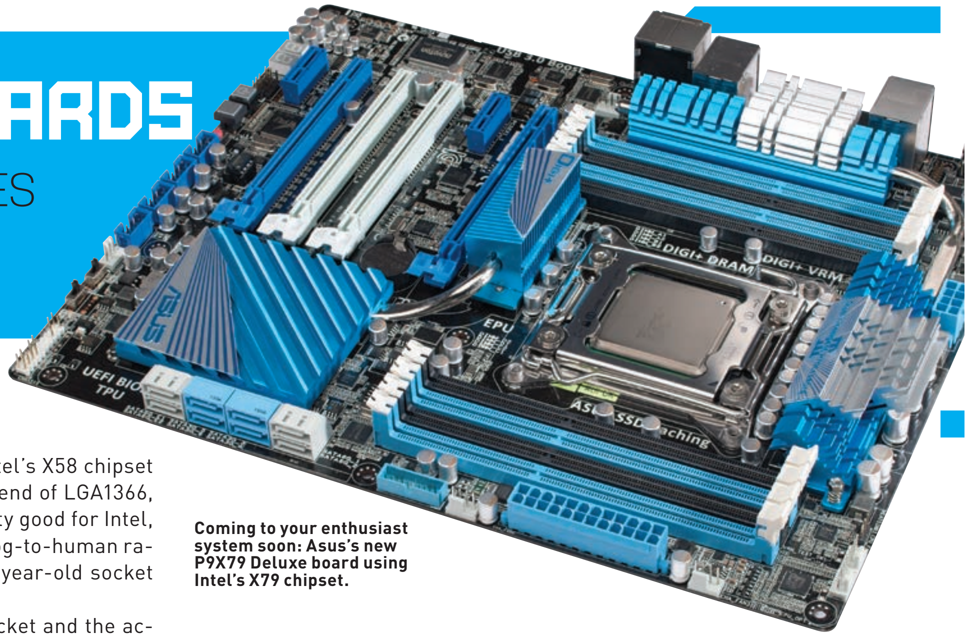
It's not all downer news for AMD, though. We saw several signs of great performance with the new chip. Up against the Phenom II X6, the FX-8150 offers a serious boost in performance in several encoding tests. In fact, in many encoding tests where the Phenom II X6 is road kill, the FX-8150 offers, umm, Sandy Bridge-like performance. In fact, in our MainConcept test where we only do one-pass rendering, the FX-8150 mangles the vaunted 2600K. In other tests, such as POV Ray, Bibble, and HandBrake, the FX-8150 pulls pretty damn close, too.

As sad as some AMD fans will be that Bulldozer doesn't flatten Sandy Bridge, it's probably as close as AMD has been in some years.

| | 3.6GHZ FX-8150 | 3.3GHZ PHENOM II X6 1100T | 3.3GHZ CORE I7-3960X | 3.4 GHZ CORE I7-2600K | 3.4GHZ CORE I7-990K |
|---|---|---|---|---|---|
| **PCMark 7 Score** | 2,838 | 2,828 | **3,662** | 3,450 | 3,332 |
| **PCMark 7 Lightweight** | 2,222 | 2,311 | **2,681** | 2,612 | 2,496 |
| **PCMark 7 Productivity** | 1,957 | 1,943 | **2,410** | 2,269 | 2,227 |
| **Cinebench 10 Single Core** | 4,080 | 4,128 | **6,363** | 6,011 | 5,176 |
| **Cinebench 10 Multicore** | 20,277 | 18,735 | **35,638** | 23,315 | 28,019 |
| **Cinebench 11.5** | 5.97 | 5.87 | **11.35** | 6.84 | 9.13 |
| **POV Ray 3.7 (sec)** | 213.08 | 227.25 | **143.1** | 218.93 | 163 |
| **Bibble (sec)** | 136 | 176 | **103** | 137 | 116 |
| **Fritz Chess Benchmark** | 11,704 | 11,504 | **13,823** | 13,065 | 13,122 |
| **Intel Burn Test (Gflops)** | 63.1 | 29 | **152** | 89.7 | 72 |
| **Sony Vegas Pro 10 (sec)** | 3,193 | 4,382 | **1,900** | 2,752 | 2,429 |
| **ProShow Producer (sec)** | 1,171 | 1,610 | **856** | 1,043 | 1,037 |
| **MainConcept (sec)** | 902 | 1,492 | **551** | 1,120 | 663 |
| **CyberLink Espresso 6.5 CPU (sec)** | 429 | 420 | **293** | 379 | 316 |
| **CyberLink Espresso 6.5 Discrete GPU (sec)** | 412 | 414 | **287** | 329 | 333 |
| **CyberLink Espresso 6.5 QuickSync (sec)** | N/A | N/A | N/A | 311 | N/A |
| **7-Zip 12 Threads (MIPS)** | 20,400 | 18,149 | **30,156** | 19,046 | **30,178** |
| **7-Zip Max Thread Load (MIPS)** | 20,773 | 17,952 | **30,156** | 19,288 | **30,178** |
| **wPrime 4-thread (sec)** | 469 | 373.8 | **301.5** | 349 | 318.1 |
| **wPrime 6-thread (sec)** | 357.07 | 256.6 | **202.3** | 293.1 | 215.3 |
| **wPrime 8-thread (sec)** | 293.7 | 260.5 | **184.5** | 248.3 | 200.8 |
| **wPrime 12-thread (sec)** | 328 | 277.2 | **148.5** | 271.2 | 165.5 |
| **HandBrake (sec)** | 345 | 383 | **234** | 336 | 283 |
| **Sandra (GB/s)** | 17.7 | 12.93 | **39.9** | 17.6 | 20.7 |
| **Valve Particle Test (fps)** | 108 | 119 | **299** | 179 | 243 |
| **Dirt 2 (fps)** | 120 | 70 | **187** | **189** | **188.4** |
| **Far Cry 2 (fps)** | 111.2 | 107.1 | **253** | 202.3 | 207.1 |
| **Unigine 2.5 (fps)** | 53.9 | 54.2 | 54.4 | 54.2 | 53.8 |
| **3DMark 11 Score** | 6,138 | 5,958 | **6,732** | 6,469 | 6,412 |
| **3DMark 11 GPU** | 6,167 | 6,118 | 6,154 | **6,186** | 6,045 |
| **3DMark 11 Physics** | 6,426 | 5,606 | **13,019** | 8,184 | 9,037 |
| **3DMark 11 Combined** | 5,569 | 5,412 | 6,602 | **6,671** | **6,547** |

# MOTHERBOARDS

## EXPECT BIG CHANGES IN THE YEAR AHEAD




Coming to your enthusiast system soon: Asus's new P9X79 Deluxe board using Intel's X79 chipset.

**WE WIND DOWN 2011** with the curtain falling on Intel's X58 chipset and LGA1366 socket. Many folks will lament the end of LGA1366, but the socket is now three years old. That's pretty good for Intel, which seems to measure its socket lifetimes in dog-to-human ratios. So, a 3-year-old socket for Intel is like a 9-year-old socket for AMD.

Replacing LGA1366 is Intel's new LGA2011 socket and the accompanying X79 chipset. A beast of a socket, LGA2011 supports enough pin-outs for four channels of RAM as well as the PCIe 3.0 connections that are now in the CPU core (see our write-up on Sandy Bridge-E for the full skinny on PCIe 3.0). Storage fiends are sure to be disappointed with X79 motherboards. The X79 chipset was originally to ship with a bountiful 10 SATA 6Gb/s connections—yes, 10!—but in the end, all we get is the same peripheral controller hub layout as the P67 and Z68—two SATA 6Gb/s ports plus four SATA 3Gb/s ports. Board vendors are making up for the deficit by adding third-party controllers for SATA 6Gb/s drives.

On the LGA1155 side, the good news is that your motherboard will survive the transition to Intel's Ivy Bridge chip. The bad news is that you may want to upgrade anyway. That's because early next year, Intel is expected to introduce its Panther Point chipset. Coupled with a new Ivy Bridge CPU, Panther Point will add an improved peripheral controller hub to improve performance and compatibility with some SSDs. On the "what took so frakking long?" front, Panther Point will also finally offer native USB 3.0 on some ports. USB 3.0 functionality should also improve when Microsofts Windows 8 ships with a native USB 3.0 stack.

On the AMD side of the aisle, there isn't much news, except that the company will introduce a new FM2 socket with its Trinity APU. Trinity essentially updates the existing Llano chip with newer cores and an updated GPU. What's not known is if FM2 CPUs will be compatible with existing FM1 motherboards.

# I/O

## AN INTERFACE WAR IS BREWING

### PCIE 4.0

There's a lesson that everyone in the city of Los Angeles wishes its builders had taken to heart: You don't wait for congestion before you lay down new infrastructure—you do it before the roads are clogged with cars.

That's the mantra the PCI-SIG has followed, and the organization isn't stopping. Before PCIe 3.0 motherboards and cards have even hit the road, the PCI-SIG is working on PCIe 4.0. The problem will lie in finding clever ways to scale the popular interface without making it a cost burden. With the move from PCIe 2.0 to PCIe 3.0, the PCI-SIG was able to double the effective speed by reducing overhead in the protocol. So, while PCIe 2.0 transfers data at five gigatransfers per second (GT/s), PCIe 3.0's transfer rate is 8GT/s, yet it doubled the bandwidth per lane from 500MB/s to 1,000MB/s.

Unfortunately, it's unlikely that PCIe 4.0 will see such a dramatic gain. The PCI-SIG hopes to keep the interface on copper instead of moving to optical, which is cost prohibitive today. PCI-SIG is considering a pay-as-you-go model, where only high-end applications need implement the highest bandwidth. Don't fret that your PCIe 3.0 board will be replaced immediately. The PCIe 4.0 spec won't be finalized until 2012, and we expect it to take until 2013 or later for it to materialize on desktops.

The PCI-SIG is also continuing to move forward with a new external cable for PCIe. The new cable could feature from one to four lanes, each capable of transferring from 2.5GT/s to 8GT/s. That means a cable could potentially transfer 4GB/s of data. At that speed, an external PCIe cable could give even Thunderbolt a run for its money.

### THUNDERBOLT

And it's Thunderbolt that the PCI-SIG and others have their eyes on, too, as that spec continues to ease forward. Earlier this year at Computex, it was thought that the new X79 chipset would include native Thunderbolt support, but it won't (although board vendors are free to add it). Intel, meanwhile, plans on releasing two new T-bolt controllers next year: Eagle Ridge and Light Ridge. The company will also release a controller called Port Ridge that will likely go into devices at the end of a Thunderbolt chain.

We're not sure if Thunderbolt is headed for victory or failure, but we do know that several motherboard vendors intend to integrate Thunderbolt controllers into next year's crop of boards as an extra feature.



### USB 3.0

The USB Implementers Forum (USB-IF) is also active. The organization hasn't laid out any concrete plans to compete with Thunderbolt and it doesn't like to spar verbally with competing standards, but officials assure us that USB 3.0 and its future iterations can take on any competing standard in performance, and its ubiquity gives it the power to truly dominate.

That ubiquity could become even greater if the organization is successful at convincing notebook makers and other electronic device manufactures to support a universal, USB-based charging system. The idea is to use standard power bricks and Micro USB plugs to charge everything from digital cameras to external hard drives, laptops, and monitors.

Consumers could then recycle power bricks instead of throwing them into the landfill. The USB-IF says it can deliver from 2.5 watts to charge a phone up to 100 watts to power a monitor or laptop. The topology would allow you to power your laptop or phone from a monitor.

In performance, USB officials say the spec has plenty of speed left. Today's USB 3.0 operates at 5Gb/s and the protocol can easily surpass 25Gb/s. Again, we don't know who will win this battle, but we know that the PCI-SIG and USB-IF don't intend to simply roll over and let Thunderbolt take over.

# STORAGE

## HDDS SPEED UP, SSDS HIT CEILINGS




**Concept drawings for SATA Express suggest that some connectors could accept either PCIe or SATA.**

### HARD DRIVES

With solid-state drives already pushing the limits of 6Gb/s SATA, and the price per gigabyte of SSDs dropping rapidly, how will mechanical drive vendors make traditional storage more appealing—aside from its still-killer price/capacity ratio? According to Seagate's Joni Clark, we can expect to see more hybrid drives toward the end of 2011 and into 2012, starting with Seagate's second-gen Momentus XT, with a 750GB capacity and 8GB of NAND cache. DIY hybrids, like the ones offered by Intel and OCZ, will continue as well, while other disk makers could introduce on-disk hybrids to compete with Seagate's.

On the desktop side, expect 1TB/platter drives to become standard in 2012, enabling one-platter 1TB drives and four-platter 4TB drives early in 2012, with a few 5TB drives here and there. From there, drive sizes will stay the same for a while until the tech for higher areal density improves and drive makers focus on speed. Seagate already announced that it's dropping 5,400rpm and "green" drives from its lineup and focusing exclusively on 7,200rpm drives. Our sources indicate that desktop hybrid drives—perhaps 1TB drives with 16GB of NAND for caching—could arrive in 2012, as well.

### SSDS

It took years to hit the 3Gb/s SATA throughput limit, but SSDs are already close to saturating the 6Gb/s spec, which has barely reached mainstream adoption. So where do they go from here? Expect drives with second-gen SandForce controllers to continue shipping through 2012, joined by other 6Gb/s controllers. Samsung has already launched its 6Gb/s controller, and Indilinx (bought by OCZ in 2011) has released the Everest 6Gb/s SATA controller, which for now is mostly powering Ultrabook-style devices. Look for SSD vendors and controller companies to continue to refine 6Gb/s performance, especially in metrics like random reads and writes and sustained writes.

Speaking of Ultrabooks: Intel's vision for ultraportable computing requires SSDs, and lots of 'em, in new form factors. mSATA and the just-announced SATA μSSDs, as well as 7mm 2.5-inch drives, will become common, if not as common as 9.5mm 2.5-inch drives.

PCIe SSDs, like OCZ's RevoDrive series, will continue to be a small part of the market, and will offer one way to bypass the 6Gb/s SATA bandwidth limit, but will eventually be supplanted by SATA Express.

### SATA EXPRESS AND SATA μSSD

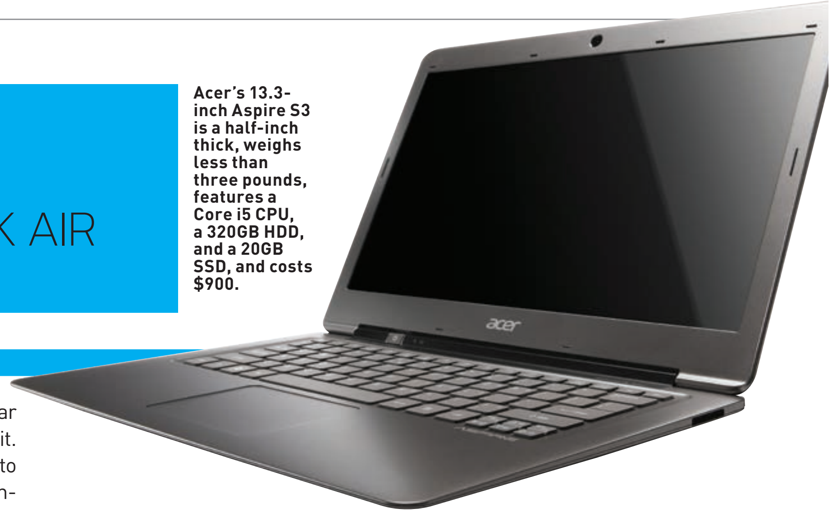
In August 2011, the Serial ATA International Organization (SATA-IO) announced two new SATA specifications for tablet devices and desktops, respectively. SATA μSSD provides a connectorless SATA specification for tablets and ultraportables. Rather than use the familiar SATA connectors, a SATA μSSD is soldered directly to the motherboard and uses a ball-grid array package to pass SATA commands to the SSD. This connectorless spec will allow smaller, faster SSDs to be used in tinier devices.

SATA Express, on the other hand, is designed to overcome the bandwidth limitations of 6Gb/s SATA without replacing 6Gb/s SATA with another spec. SATA Express uses the PCIe interface but with SATA software commands. The specification is still being worked on, but concepts we've seen show both PCIe/SATA combo connectors and dedicated SATA connectors that use the PCIe form factor and pin-outs. SATA Express will allow 8Gb/s and 16GB/s connections.

Both SATA Express and SATA μSSD are scheduled to appear in the second half of 2012, but since neither specification is due to be finished until the end of 2011, there's a chance neither will appear in 2012 at all.

# ULTRABOOKS

## THE EVERYMAN'S MACBOOK AIR




Acer's 13.3-inch Aspire S3 is a half-inch thick, weighs less than three pounds, features a Core i5 CPU, a 320GB HDD, and a 20GB SSD, and costs $900.

**ACCORDING TO INTEL,** 40 percent of all consumer laptops sold next year will be Ultrabooks. In fact, the company has staked $300 million on it. That's the figure behind Intel's Capital Ultrabook Fund, which goes to companies that develop hardware and software technologies to enhance the Ultrabook experience.

So what is an Ultrabook? By Intel's own definition, it's a notebook that's no more than 21mm (or .83 inches) thick; that features at least five hours of battery life, but preferably as much as eight hours (as measured by MobileMark 2007); that can resume power from hibernation in seven seconds or less using Intel's Rapid Start technology; and that exposes hardware features for Intel's Anti-Theft and Identity Protection technology in the BIOS/firmware.

The cornerstone of the Ultrabook experience, however, is an Intel CULV processor. The category will launch at the end of 2011 with second-gen Sandy Bridge CPUs, but it's expected to really take off when Ivy Bridge CPUs are released in 2012. Intel believes that the combined power efficiency and performance capabilities of its low-voltage procs with integrated graphics—when packaged in a sleek, highly portable form factor—will make Ultrabooks a compelling alternative to tablets.

Of course, another very important factor to the Ultrabook equation is price. After all, no one is going to pass over a $200 (thanks, Amazon!)–$500 tablet in favor of a $1,300 thin-and-light, no matter how capable or energy efficient it might be. That's why Intel is strongly encouraging its OEM partners to price their Ultrabooks below $1,000. At that price point, Intel believes, consumers can be swayed by value.

Price, however, is not a requirement for the Ultrabook designation. And indeed, at least a couple of the early models slated for 2011 release appear to be priced at over a grand. Lenovo's U300s, for example, is expected to retail at $1,200 for the base model (1.6GHz Core i5-2467M and 128GB SSD) and $1,600 for the step up (1.6GHz Core i7-2657M and 256GB SSD). Pricing for Toshiba's upcoming Z830 Ultrabook has yet to be announced. But with Acer's Aspire S3 debuting at $900, we might see price pressure come to bear on future models.

As Intel sees it, a ramp up in production, the development of new, focused technologies (à la that $300 million fund), and the performance enhancements of Ivy Bridge could make Ultrabooks the must-have mainstream device of 2012.

# TABLETS

## WE NEED MORE POWER!

**IN THE SPAN OF NINE MONTHS**, 2011's tablet SoC of choice, the Nvidia 1GHz dual-core Tegra 2, has gone from blazing to blasé. Expect 2012 to be the year of the quad-core tablet. As early as February of this year, both Nvidia and Texas Instruments had announced the early stages of their quad-core mobile chip development.

Nvidia's Project Kal-El uses Variable Symmetric Multiprocessing (vSMP) and promises tantalizing benefits, such as lower power consumption, higher performance per watt, faster website load times, console-quality gaming, faster multitasking, etc. It packs four ARM Cortex 9 CPUs, a fifth companion core for low-power operation, and a 12-core GPU onto one chip. CoreMark benchmark results showing roughly double the performance from a Tegra 2 to Kal-El were run with 1GHz cores in the Kal-El. We expect those cores to clock in at 1.5GHz when the Kal-El hits production smartphones and tablets.

TI's quad-core OMAP 5 touts similar benefits and will comprise two ARM Cortex-A15 cores (up to 2GHz) and two slower ARM Cortex-M4 cores.

Typical 10-inch Android tablet display resolutions of 1280x800 will no doubt ramp up next year. Fusion Garage CEO Chandra Rathakrishnan thinks the resolutions may double the present number of total pixels, and Ted Theocheung, VP of the PC division at Synaptics, believes tablets will gravitate to full 1080p resolution (1920x1080) as early as 2012 or as late as 2013.




Nvidia's quad-core Project Kal-El SoC adds a fifth "companion" CPU to handle low-power and background tasks, such as email syncs and social media updates.

However, too much added resolution increases the price of the display, power consumption, and processor load. Dr. Raymond Soneira of DisplayMate Technologies says, "A good technical and marketing compromise for tablet resolution is 200ppi. For the 10.1-inch Android tablets, 1792x1120 works out to 209ppi."

Soneira adds that the first tablets with OLED displays should debut in 2012, although at high-end prices. Meanwhile, high-performance in-plane switching (IPS) LCDs like those in the iPad 2 and Kindle Fire will become the norm as manufacturers forsake the inferior STN LCDs seen on the Motorola Xoom and Acer Iconia.

Theocheung brings further good tidings, saying that tablets will become thinner. "The removal of a discrete touch sensor will help reduce the thickness," he says, "allowing the overall stack-up of the traditional touch sensor module to shrink down to as thin as 0.55mm." Theocheung's work with Microsoft also foretells of new multitouch breakthroughs in Windows 8 that will allow slate computers to perform full-time finger tracking of up to 10 fingers, whereas most current models top out at five.

"The whole spectrum of hardware innovation that you see in the PC space will be carried over to the tablet world," Rathakrishnan predicts.

# GRAPHICS

## WILL GPUS INSIDE CPUS TAKE OVER THE ENTRY LEVEL?

**PRICES ON GRAPHICS** cards have seen massive cuts in the past few months. While that's great for gamers looking to upgrade, it's also a sign that new GPUs are on the horizon. When are we likely to see next-generation GPUs and graphics cards?

### PROCESS PERILS

That's a tough question for several reasons. One of the key manufacturers of GPU chips, TSMC, is prepping its next-generation 28nm manufacturing process, which is likely online now. Demand has been extremely high, though, forcing the company to hike prices, and thus pushing back shipments of 28nm GPUs.

That said, AMD demonstrated its 28nm next-generation GPU at its Fusion 2011 event in Taiwan in October. And a leaked mobile GPU roadmap indicates that AMD products will ship in early 2012 for mobile applications. The AMD 7000-series desktop graphics cards will also likely make an early 2012 appearance.

### RAMBUS RETURNS?

What's interesting about AMD's new architecture is a greater emphasis on compute capabilities. While the 6000 series was no slouch on the compute front, that GPU design wasn't as tuned for compute as Nvidia's Fermi architecture. AMD's goal is to share the same memory space as the CPU, making it easier for software developers to write apps that utilize the GPU—although the 7000 series may not quite hit that target. The other interesting tidbit leaked recently is that AMD might be using RAMBUS XDR2 memory, running at up to 8,000MHz effective throughput.

There is some confusion about the process technology. One leak showed early 7000-series GPUs being built on the existing 40nm technology. This isn't unprecedented; the Radeon HD 6970 was originally targeted for 28nm, but ended up shipping on 40nm. Whatever process technology is used, the lowest-end card to show up on any roadmap is a Radeon HD 7950. More on that in a moment.

Nvidia is also busy as a bee, prepping its next-generation graphics cards based on its Kepler architecture. It's looking like the first samples of Kepler GPUs are on track for a late 2011 delivery to Nvidia. That means a late winter or early spring 2012 ship date for retail cards, at best. Like AMD's new GPUs, Kepler will be built on 28nm. Nvidia's been fairly quiet about Kepler, unlike its openness regarding Fermi, so little is actually known about features. Kepler is likely to be a significant enhancement to Fermi, but not a complete architecture redesign.

So it's likely we'll see midrange and high-end graphics cards in the first quarter of 2012. Meanwhile, entry level graphics are going through a quiet revolution.

### THE FATE OF THE ENTRY LEVEL

Part of that is AMD's push for Fusion. We've already seen the first Fusion APUs from AMD, and while the traditional x86 CPU performance is somewhat anemic, the GPU is clearly stronger than any previous integrated GPU. Offering up to 400 Radeon GPU cores, the GPU inside the higher-end 3800 series APUs gives a tantalizing glimpse into the future of PC graphics.

For its part, Intel made gains with the Intel HD Graphics on Sandy Bridge, particularly on the video side. When Ivy Bridge debuts in early 2012, expect the CPU itself to be an incremental improvement, but graphics to be significantly improved, offering full DirectX 11 support, double the compute horsepower, and greater bandwidth. Ivy Bridge will likely be "good enough" for entry level gamers.

High-end gamers, of course, will still want to add a discrete graphics card, but mainstream users may not need additional GPU horsepower. Intel has hinted that Ivy Bridge's GPU will run OpenCL and DirectCompute applications entirely on the GPU cores, which would be a significant departure for an Intel GPU.

### PREP YOUR WALLETS

So, yes, if you're looking to upgrade, prices are very attractive for current-generation cards, but it might pay to hold off until new midrange and high-end graphics cards from both AMD and Nvidia partners arrive, certainly by spring of 2012. After all, every time we think that GPUs have gotten fast enough, games like Deus Ex: Human Revolution and The Witcher 2 come along that crush current-card performance.

## LOOKING FORWARD

### The PC of 2013

**NOW YOU KNOW** what the PC is likely to look like in 2012, but what kind of rig will enthusiasts be rocking in 2013? To figure it out, we gaze into our crystal ball. We suspect LGA2011 motherboards will remain the platform of choice. By then, Intel should have introduced Ivy Bridge-E. We suspect that the thermal savings from the switch to 22nm will help Intel get the eight-core version of Ivy Bridge within reasonable thermal limits.

By 2013, DDR4 will still be in gestation, so we don't think our machines will yet sport the next-gen memory. We do, however, suspect that RAM prices will have come down drastically. So, while a fully loaded Sandy Bridge-E machine might pack 32GB of RAM—eight 4GB modules—(for just $200), a 2013 Ivy Bridge-E rig might pack 64GB—eight 8GB modules—at proportionate pricing.

By 2013, PCIe 3.0 GPUs will have long been available, but we won't even hazard a guess as to which brand—AMD or Nvidia—will be on top. SSD's will have grown, but will be bottlenecked by SATA 6Gb/s, still. By then, it's possible prices will have dropped so you can get a 480GB SSD for $250, though. HDD space will remain static at roughly 5TB, which it will hit in 2012.


PLEXTOR

BY NATHAN EDWARDS

# BUILD A BATTLEFIELD 3 PC

## YOU CAN'T GET THE FULL BF3 EXPERIENCE ON A CONSOLE, BUT WHAT DOES IT TAKE TO GET IT ON A PC?

**IN AN AGE OF SLOPPY CONSOLE PORTS,** Battlefield 3 is a huge relief for PC gamers. Not only is the PC a "lead platform" for DICE's flagship modern shooter, but we're getting all the good stuff: 64-player maps? You won't find 'em on a console. DirectX 11 graphics? Only on a PC, Sparky. Indeed, Battlefield 3's Frostbite 2 engine brings fully destructible environments, ambient occlusion, MLAA, and full DX11 support—and it reaches its full potential only on the PC. But with great power comes great power requirements: DICE's minimum recommended GPU is a GeForce GTX 560 or AMD Radeon HD 6950, and performance scales up from there. That means a lot of us are going to have to go get new videocards—or a whole new rig.

Any Neanderthal can slap together a $3,000 box and play Battlefield 3 like a dream, but that's out of reach for most people. So we decided to build a machine that can play BF3 as nature intended—at 1920x1200 resolution, with all settings at Ultra—and do it for less than $1,600.

Print deadlines being what they are, we didn't have access to the final Battlefield 3 code, but we played the open beta and used Battlefield 3-optimized drivers from AMD and Nvidia as they became available.

We'll start by explaining the parts we chose and why. Some were obvious, and some—like the videocards—changed multiple times. Then we'll talk about our testing and gameplay experience, and describe some alternate configurations. If you've ever needed a good excuse to upgrade or build a new rig, Battlefield 3 just might be it.







CPU

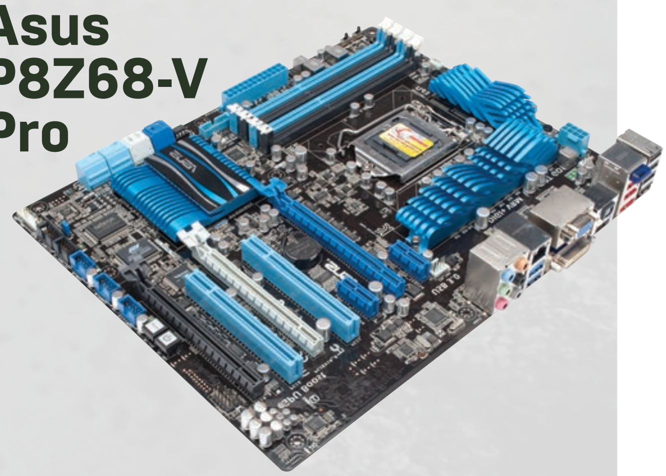
## Intel Core i5-2500K




**WE THINK** the Core i5-2500K is the best midrange processor on the market. It's a 3.3GHz quad-core chip, and though it lacks Hyper-Threading, it's multiplier-unlocked and overclocks like a dream, thus extending its usable lifespan (though we left ours at stock speeds for this rig). Sandy Bridge is a great platform, and the 2500K hits the price/performance sweet spot for that platform. Bulldozer and Sandy Bridge-E CPUs weren't available when we built our system, but even if they were, we'd probably still go with the 2500K. It's that good a value.

MOTHERBOARD

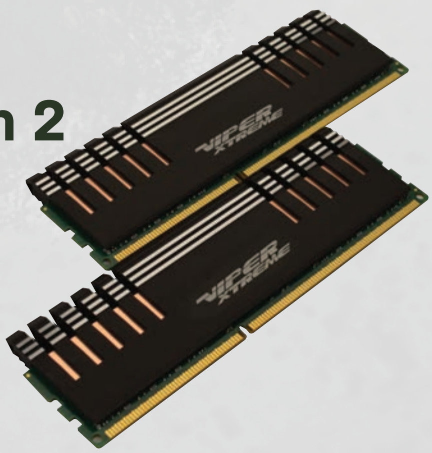
## Asus P8Z68-V Pro



**ASUS'S P8Z68-V PRO** is the perfect complement to our i5-2500K. Not only does it have Intel's excellent native 6Gb/s SATA chipset and USB 3.0 support, but it also brings three PCIe x16 slots—although the third is restricted to x4 mode, and the first two, if both used, default to dual x8 speeds. A UEFI BIOS enables use of hard drives bigger than 2.2TB, and Intel's Smart Response Technology (SRT) is an option if you prefer a large mechanical boot drive with a small SSD for caching—an option we considered before settling on the final storage loadout.

RAM

## 8GB Patriot Division 2 DDR3/1600




**DICE'S MINIMUM** RAM requirement for Battlefield 3 is 2GB, and its recommended specs call for 4GB. 4GB is, frankly, the bare minimum we'd consider putting into a new rig, and it's not very future-proof. The Z68 chipset is dual-channel, and our motherboard has four DIMM slots. With memory prices so low, it only made sense to go with two 4GB DIMMs. That gives us 8GB of RAM now, and room to double up later.

GPU

## XFX Radeon 6970 2GB




**THIS WAS THE** trickiest part to pick. Throughout the beta period, Nvidia and AMD kept releasing beta drivers that would put their respective GPUs in the lead. AMD's second preview drivers, though, kicked the 6970's average frame rate on Ultra at 1920x1200 up to 45fps on our system—well in the playable range, and for $150 less than Nvidia's GTX 580. If we had gone with the GTX 560 Ti or Radeon 6950, we would have had to ratchet down the graphical quality or the resolution. With the Radeon 6970 we get a tasty balance of performance and price.

SSD

## 120GB Corsair Force GT




**OUR ORIGINAL PLAN** called for a 3TB boot drive with a 40GB SSD for caching via Intel's SRT. That install fell over and died twice, thanks to some bugs with SRT and drives greater than 2.2TB, so we went back to the drawing board. We decided on a blazing-fast 6Gb/s SATA SSD with 120GB of storage as our boot drive. That's enough for the OS and a few of our favorite games and applications, with a larger traditional hard drive for documents, movies, music, and other media. A 120GB drive, right now, is the sweet spot between price and capacity.

HARD DRIVE

## 2TB Hitachi Deskstar 7K3000



**WE HAD OUR EYES** on a 3TB Deskstar and 40GB SSD, as noted previously, but—in addition to the aforementioned buggy install—we realized we could get a 120GB SSD and 2TB drive for around the same price. We figure we'll miss 1TB of mass storage less than we'd miss the ultra-fast load times of a dedicated SSD for our OS and gaming. For now, two terabytes is plenty for us, and the Deskstar is both speedy and reliable.

PSU

## 750W Corsair TX750 V2




**NOT MUCH TO TALK** about here; we needed power. Power enough to run our rig without stuttering, freezing, or crashing. Power that doesn't cost an arm and a leg. Corsair's TX750 V2 isn't frilly or fancy—we didn't spring for the modular version—but it does what it says on the tin, and that's enough. 750W is sufficient for our solitary Radeon HD 6970, and should even enable us to throw another card in the system later, if we so choose.

CASE

## Rosewill Thor v2



**FOR PRICE-CONSCIOUS** builds we normally opt for mid-tower chassis, as they're usually less expensive than their full-tower kin. However, we reviewed Rosewill's Thor V2 last month and it really captured our imagination. Either it's well built for a budget full-tower, or it's cheap for a good full-tower, but either way, we dig its roomy interior, easy cable routing, and fantastic stock cooling. The Thor has two variable-speed fan controllers that support three fans each; we connected its intake fans (23cm, front and side) to one and its exhaust fans (14cm rear and 23cm top) to the other.

## INSIDE SCOOP

**1**
The Cooler Master Hyper 212 Plus is our favorite step-up-from-stock CPU cooler.

**2**
The Thor has room for even the longest of graphics cards.

**3**
We skipped a Blu-ray player to save money. Why watch movies when you can play games?






| PRICE LIST | PART | URL | PRICE |
|---|---|---|---|
| Case | Rosewill Thor V2 | www.rosewill.com | $130 |
| PSU | Corsair TX750 V2 | www.corsair.com | $120 |
| Mobo | Asus P8Z68-V Pro | usa.asus.com | $199 |
| CPU | Intel Core i5-2500K | www.intel.com | $220 |
| CPU Cooler | CM Hyper 212 Plus | www.coolermasterusa.com | $30 |
| GPU | XFX Radeon 6970 2GB | www.xfxforce.com | $350 |
| RAM | 2x 4GB Patriot Division 2 DDR3/1600 | www.patriotmemory.com | $80 |
| Optical Drive | Plextor DVD/combo | www.plextor.com | $25 |
| SSD | 120GB Corsair Force GT | www.corsair.com | $220 |
| HDD | TB Hitachi Deskstar 7K3000 | www.hitachigst.com | $120 |
| OS | Windows 7 Home Premium, 64-bit OEM | www.microsoft.com | $100 |
| TOTAL | | | $1,594 |

# OUR BATTLEBOX IN ACTION



## YOU GO TO WAR WITH THE DRIVERS YOU HAVE

**BUILDING A RIG TO PLAY** a game that hasn't come out yet presents some unique challenges. The Battlefield 3 beta was only open for a brief time, didn't include a benchmarking tool, and, well, wasn't the final shipping code. Also, throughout our testing, both Nvidia and AMD released updated Battlefield 3-specific beta drivers, which drastically improved performance with each respective company's cards. We tested performance by running the Fraps utility (www.fraps.com) throughout a series of matches in the beta, then taking the average frames per second from each playthrough and averaging them.

For our Battlebox, we set a simple performance goal: We wanted a rig that could play Battlefield 3 at 1920x1200 at Ultra, the highest of its four performance presets, without having to turn down any of the settings. Neither the GTX 560 Ti nor the Radeon HD 6950 could stay above 35fps at Ultra, though both were fine at 1920x1200 on the High preset. Nvidia's GTX 580 delivered excellent performance at Ultra, averaging more than 45fps with the 285.38 beta drivers, while AMD's Radeon HD 6970, using the first set of Catalyst 11.10 preview drivers, mustered an average of 35fps—playable, but not quite the frame rate we were looking for.

However, just a few days before the open beta period ended, AMD released the Catalyst Preview 11.10 (version 2) drivers, which promised big Battlefield 3 performance gains. And boy, did they deliver. The new drivers let our Radeon HD 6970 average 42fps in Battlefield 3's Operation Metro map. That's an average frame rate we're comfortable with—enough to choose the Radeon HD 6970 over the GTX 580. The GTX 580 is an objectively faster card, and Nvidia's release drivers will doubtless bump its performance higher than the 45fps we saw. But the Radeon is $150 cheaper, and in a rig that's all about bang for the buck, we couldn't pass it up.

It goes without saying that upping your GPU will up your performance. DICE's "recommended system requirements" for Battlefield 3 advises using an Nvidia GeForce GTX 560 or AMD Radeon HD 6950. Nvidia provides more detail, saying that a GTX 560 or higher will play the game at 1920x1200 at High settings, while a 580 is required for Ultra settings. This is borne out in our testing. If you're OK with High quality, or you're playing at a lower resolution, you can get away with a GTX 560 or Radeon HD 6950. For Ultra at 1920x1200, we recommend a Radeon HD 6970 at minimum. The more GPU you bring to the game, the better it will look.

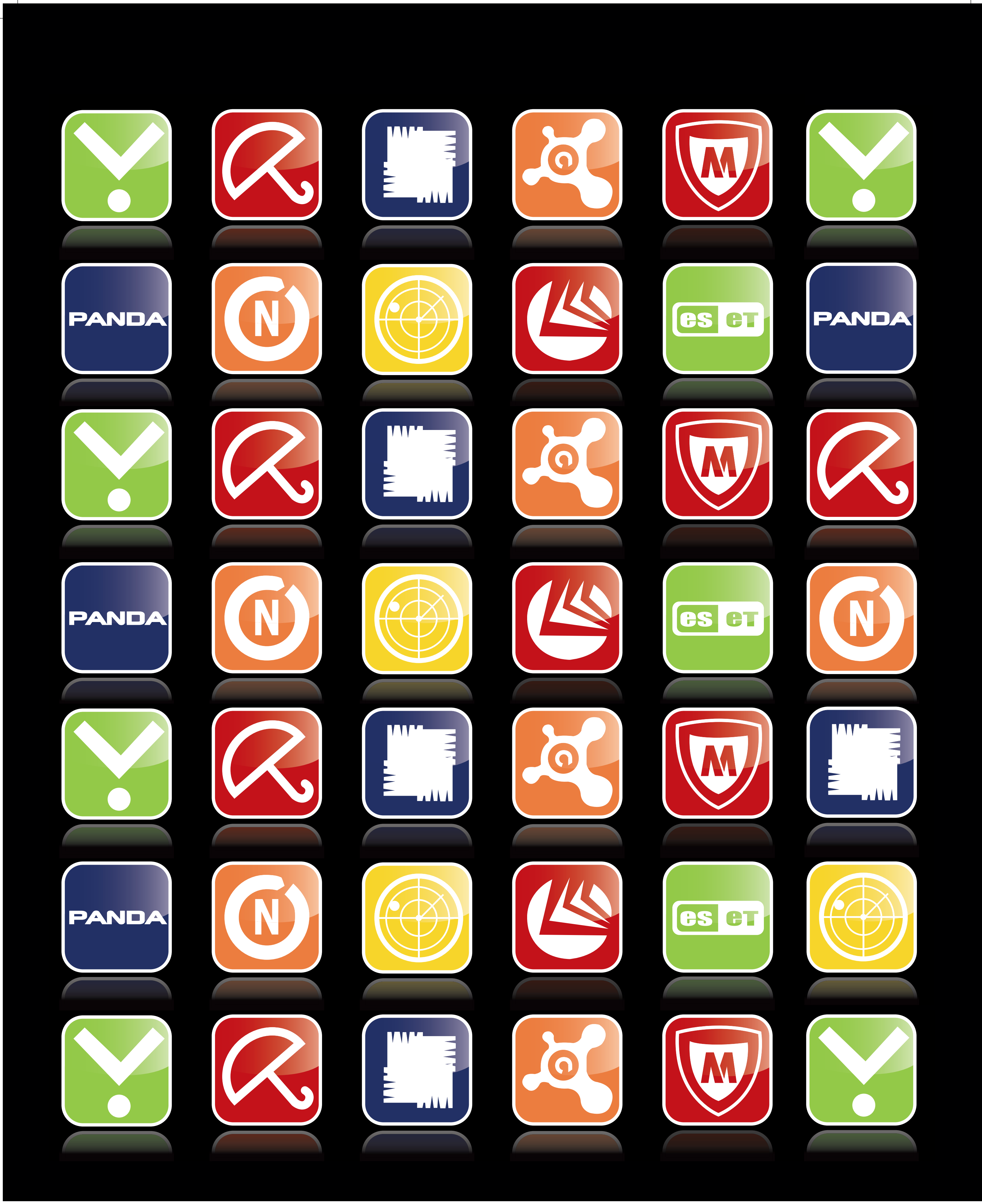
If you've built a gaming system in the past few years, you shouldn't have to do much to ready your rig for Battlefield 3, beyond adding a bit of RAM, perhaps, and upping your GPU power a bit. If you're running a Radeon HD 5870 or 6870, or a GTX 480 or 570, you probably don't need to upgrade at all. If you have a midrange card, you might consider adding a second one for an SLI or CrossFire configuration.

One thing the frames-per-second numbers don't tell you is how awesome Battlefield 3 looks at Ultra settings. Shoot, it even looks fantastic on High. So even if your current videocard is ancient, you can swap it out for a GTX 560 Ti or Radeon HD 6950 and still get a kick-ass experience—for less than the cost of a console. Don't get us wrong—we're sure BF3 will be just fine on a console, if you're OK with the 24-player maps, plodding dual-analog controllers, and prehistoric graphics.

We're super-excited for Battlefield 3, as much for its unabashed PC-centricity as its gameplay, which is addictive as all get-out. But if Battlefield isn't your bag, never fear—the rig we built is a great general-purpose gaming PC, with enough power to handle any modern game you care to throw at it. We just happen to want to throw Battlefield 3 its way and never stop playing.



The game looks even better in motion. Plus, you can blow up the trees.


PANDA
eset

# CHOOSE YOUR DEFENDER!

**BY PAUL LILLY**

## WE TEST 10 OF THE MOST POPULAR AV PROGRAMS LOCK, STOCK, AND BARREL!

SELECTING AN INTERNET SECURITY SUITE IS A LOT LIKE PLODDING THROUGH A CHOOSE-YOUR-OWN-ADVENTURE BOOK. REMEMBER THOSE? The path of the protagonist was entirely up to you, and if those books taught us anything at all, it's that every decision carries with it potentially devastating consequences. The same thing applies to your choice of antivirus software, only the repercussions of malware are real, and if a shoddy security suite fires off a blank and leaves you exposed to danger, there's no flipping back the pages for a do-over.

The stakes are high, and it's important you choose the right defense the *first* time. If you don't, you risk leaving your system vulnerable to attack from an increasingly sophisticated arsenal of digital artillery. And don't expect cyber-scoundrels to fight fair. They'll lace screensavers and kids' games with malware, spoof email addresses, record your keystrokes, and perform all sorts of underhanded tactics. Your PC is a gold mine of valuable information, and once compromised, these crooks will attempt to steal your identity, swipe your credit card information, pillage your PayPal account, lift your bank login credentials and sell 'em to the highest bidder, or any number of insidious schemes. If all that weren't enough, malicious software can render your once-fast PC a pop-up-infested jalopy. Is there any hope?

That's where we come in. We've called to arms a gnarly collection of security suites with the roughest, toughest reputations around. We're also including three popular no-cost AV solutions to find out how they compare. Flip through the pages to get started, and if we miss one you think should have been included, let us know—we'll run stand-alone reviews of even more AV apps in future issues.

# WHAT MAKES A GOOD AV APP?

## WE RELY ON FIVE KEY CRITERIA

**SYSTEM PERFORMANCE AND SCAN SPEED**

As power users who give a damn about performance, we're picky about what we install on our systems. We gauge each AV app's overall footprint by comparing boot time, PCMark 7 and Vantage scores, and the time it takes to transfer 6GB of files to that of a pre-AV state. We also take scan speed into consideration because, let's face it, if you have reason to run a manual sweep, do you really want to sit around all day waiting for a clean bill of health? Neither do we.

**ANNOYANCE**

Dealing with a potential malware infection is stressful enough, so the last thing we need is to be agitated by our security suite. A good program won't provoke us with constant pop-ups trying to upsell security or crying wolf about legitimate programs. In fact, we shouldn't even know it's there most of the time. And when we do cross paths, we expect to be able to navigate the UI without ending up frustrated and wanting to fist-slam our keyboard.

**FEATURES AND IMPLEMENTATION**

We know how to roll our own security using a mishmash of free programs on the web. But the whole point of an Internet security suite is to bundle everything we might possibly need into a single package, saving us the hassle of managing a bunch of separate programs. There's value in that, but we're also looking for meaningful additions and not just a truckload of features for the sake of building a bigger bullet list than the competition.

**PRICING**

Seven of the 10 AV programs in this roundup are fully fledged security suites that require an annual subscription plan. The onus is on each and every one to justify its price tag and convince us we should be pouring money into an all-in-one security package instead of building our own protective bubble with freeware alternatives. The higher the subscription, the harder it will have to work to sell us on paid security, plain and simple.

**VIRUS DETECTION**

This is where the rubber meets the road, so it carries more weight than any other category. To determine how well a security program performs, we run several synthetic spyware and virus tests found on www.spycar.org and www.eicar.org. We then dart through the seedier side of the web with reckless abandon, followed by firing off a shotgun full of malware samples. When the dust settles, we compare our results with that of independent testing labs Virus Bulletin (www.virusbtn.com), AV-Comparatives (www.av-comparatives.org), and AV-Test (www.av-test.org).

# PANDA

## INTERNET SECURITY 2012

There's a reason it's called Panda and not Cheetah

**THIS IS THE THIRD YEAR RUNNING** that we've included Panda's Internet security suite in our antivirus roundup, and like the previous two times, this year's model sports a new skin. It's too bad Panda didn't focus its attention where it's needed most: on the inside. Panda continues to scan files with all the urgency of a slug, a problem that's plagued this program for as long as we can remember. What's worse is that scan times never improve.

Panda's scan engine isn't fast, but it's effective, at least in ravaging real-time threats. More often than not, Panda prevented malicious websites from loading, and on the rare occasions it didn't, the on-demand scanner obliterated dirty downloads before they could touch the desktop. It wasn't quite as effective in clearing up existing infections, leaving traces of neutralized malware behind.

One way Panda improved over last year's version is in scaling back the number of pop-ups. They're not completely gone, but Panda's firewall no longer freaks out whenever it detects activity on your network. Panda still implores you to register (there's no option to permanently disable the reminder), and a persistent ad in the UI tries to upsell security, though you can disable it in the Preferences menu.

Panda's slow-loading menu feels heavy. At the same time, it's easy to navigate and brimming with options. We especially appreciate the virtual keyboard for those times when paranoia sets in, and the Safe Browser option is a nifty concept, if only we could get it to work. It's supposed to load a sandboxed browser to keep web surfing sessions isolated from the OS. Great, only it refused to load after going through a lengthy setup process that walked us through installing a dated version of Sun's VirtualBox.

We like Panda overall, but its quirks are tough to bear.




**Panda sports a sleek new look, but it's running the same slow scan engine as before. Pick up the pace, Panda!**

**VERDICT 7**

**Panda Internet Security 2012**

$61 (1 year, 3 PCs), www.pandasecurity.com

# KASPERSKY
## INTERNET SECURITY 2012
Good for touch-screens and keyboard/mouse users alike




**Rocking an all-in-one PC with a touch screen? You'll love Kaspersky's oversize tiles, which are easy to manipulate with a good old rodent, as well.**

**FOR ITS 2012 PRODUCT, KASPERSKY** put a great deal of effort into making security management less intimidating. This is evident from the moment Kaspersky loads for the first time. It starts with the redesigned Windows widget (provided you're running Windows 7 or Vista), which lets you know the status of your security software at a glance. You know the drill—green means all systems are go, yellow indicates a problem with security, and red means it's time to panic (or press the button to fix whatever's freaking Kaspersky out). You can customize each of the four quick launch buttons, and if you drag a file or folder on top of the widget, Kaspersky will scan the contents. It's all very slick.

Kaspersky's updated dashboard is equally user friendly and looks as though it was designed with touch screens in mind. Stifle the groans, because it's a cinch to navigate with a mouse. The top portion is dominated by a status window that lets you know if there are any pressing matters that require your attention, and below that sits a scrollable row of oversize icons. Kaspersky displays four at a time, or you can press the up arrow to stretch the section up over the status window. Kaspersky didn't forget about power users, and if you want to get your hands dirty, you can dig several layers deep by clicking Settings.

The changes in KIS go beyond the cosmetic. Kaspersky injected the scan engine with a much-needed dose of nitrous oxide, but it might be a little too fast. Several dirty files went undetected as we downloaded them to the desktop, though Kaspersky sprang into action when we tried to execute them. Combined with high scores from independent testing labs, we remain fairly confident in Kaspersky's ability to keep malware at bay.

**VERDICT 8**

**Kaspersky Internet Security 2012**

$80 (1 year, 3 PCs), www.kaspersky.com

# BITDEFENDER
## INTERNET SECURITY 2012
Silent as a ninja and almost as lethal

**IT'S EASY TO FORGET** you have Bitdefender installed on your system—that is, if you want to. One of the big new features in this year's build is an Autopilot mode. When engaged, Bitdefender plops itself into the driver's seat and navigates through potentially sticky security-related situations without any supervision. The idea is to provide protection in absolute silence, and this stealth approach works so well that we initially thought Bitdefender had fallen asleep at the wheel. Turns out Bitdefender had its eye on the road the entire time, though it was sometimes slow to react. What we mean is that Bitdefender didn't always stop dirty downloads from reaching the desktop, nor did it block us from pulling foul files off our USB flash drive. Pretty soon our once-clean desktop had turned into a virtual minefield of malware.

After a while, most of these files began to disappear one by one. It started with the ones we clicked and then spread to others we hadn't. Bitdefender disarmed almost every threat and proved particularly adept at weeding out rootkits, though it did let a trojan add an entry to the registry. As far as we can tell the actual virus had been neutralized, and even though all the independent labs laud Bitdefender's detection rates, its seemingly slow reaction time leaves us feeling a little uneasy.

Bitdefender is overflowing with features. All the essentials are there—antivirus, antispyware, antispam, firewall—and so are loads of extras like identity-theft protection, parental controls, a rescue mode that reboots your PC in a trusted environment, social network scanning, a virtualized browser, and the list goes on. To top it off, the new menu layout is both easy to navigate and customizable. Bitdefender clearly understands what we want from a security suite.




**Bitdefender's awesome Autopilot will make you forget you're even running security software.**

**VERDICT 9**

**Bitdefender Internet Security 2012**

$50 (1 year, 3 PCs), www.Bitdefender.com

# NORTON
## INTERNET SECURITY 2012
An era of excellence continues

**IT'S BEEN THREE YEARS** since Symantec overhauled its Norton security line, yet we still feel compelled to mention it. Why? For the simple reason that it's not easy reinventing yourself, and there are still those who view Norton as a bloated, flat-footed application built on shoddy code. The truth is Symantec turned its Norton product around in 2009 with a code base it rewrote from the ground up, and Norton's been earning high marks ever since.

Symantec took it a step further last year by giving the UI a face-lift. What emerged was sleek and sexy, and at the same time overwhelming for less experienced users or anyone uninterested in such fine-grain control. NIS 2012 solves this problem by removing most of the clutter from the main screen and sweeping it beneath the rug where power users can still get to it. The result is a user-friendly UI dominated by three main controls: Scan Now, LiveUpdate, and Advanced. If you happen to miss the way things used to look, Norton lets you pin the Advanced menu to the main window, which has the added bonus of covering up the goofy world map that shows cybercrime activity hotspots. Seriously, does anyone use this?

Other changes in NIS 2012 are equally subtle and effective, like the small Windows gadget Norton installs. Also new is the ability to remotely manage multiple Norton subscriptions from the web (handy feature for updating mom's machine), the ability to scan your Facebook wall for malicious links, and a Reputation scan for determining a file's trustworthiness.

Norton added 16 seconds to our system's startup time, tying for last place. If you want, you can disable or delay the start of programs through Norton's new Startup Manager. It's similar to the one built into Windows, but far more robust and easier to use, and it reports resource usage (displayed as Low, Medium, or High). As before, Norton skips scanning unaltered files after the first pass-through, so an initial eight-minute scan was reduced to a little more than two and a half minutes.

In terms of protection, Norton continues to impress, both during internal tests and also those conducted by independent testing labs. Symantec tells us it's added 120 new rules to Norton's Sonar module, which is now better at detecting not only non-process threats like those hiding in DLL files, but also fake AV programs. We tried our best to trip up Norton, but it stood tall throughout testing.




**If Symantec ever removes Norton's real-time (and real hokey) Threat Map from the UI, we won't have anything left to piss and moan about.**

VERDICT 9 KICK ASS!

**Norton Internet Security 2012**
$70 (1 year, 3 PCs), www.norton.com

Terminology 101

## MALWARE IN ITS MANY FORMS

**MALWARE VS. VIRUS:** The first thing you need to know is that malware is a generic term used to describe any malicious program. If it's unwanted and insidious, it's malware (or iTunes—zing!). Even though they're often confused, malware is not the same as a virus, though a virus is a common form of malware. Viruses are pieces of unwanted code that latch on to legitimate programs and can self-replicate. They're often unwittingly spread through email attachments, USB thumb drives, and file sharing.

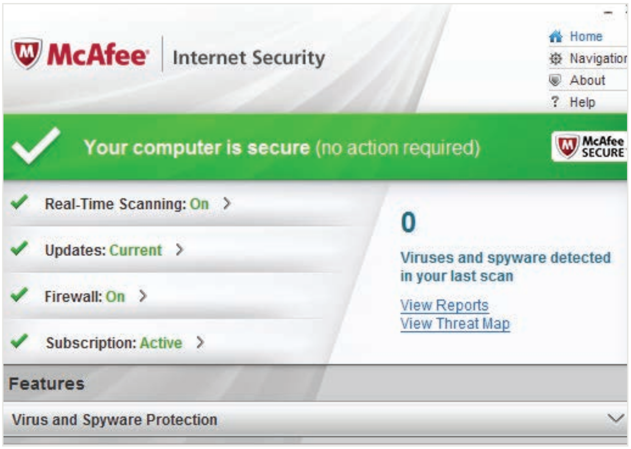
**WORMS:** Like a virus, a worm self-replicates, but it doesn't need to attach itself to a host file. Worms burrow into your network looking for vulnerabilities to exploit and spread to other systems.

**TROJAN:** Like the horse of Greek mythology, a trojan masquerades as something awesome—a psychedelic screensaver or card game, for instance—but hides a terrible surprise. In other words, it appears to be something that it's not. Trojans can't replicate themselves like a virus, but once you run or install a trojan, it gets to work opening back doors or whatever evil deed the author intended it to do.

**SPYWARE:** Just what it sounds like, spyware is any unwanted program designed to spy on your activities. It might be a program that logs your keystrokes (keylogger) or tracking software that gathers information about you without your knowledge or consent.

**ADWARE:** To keep it short and simple, adware bombards you with ads. Some examples include random pop-ups, unwanted banner ads, and browser redirects.

# MCAFEE
## INTERNET SECURITY 2012
Light on its feet, but too easily tripped up by malware




**McAfee hasn't changed its appearance since 2010, but its real blemishes are beneath the surface.**

**TWO YEARS AGO WE** applauded McAfee for giving its security suite a much-needed makeover. McAfee apparently decided to leave well enough alone, as the UI looks identical to both the 2011 and 2010 models. We're not advocating change for the sake of change, but compared to the current crop of AV applications, McAfee's menu layout has fallen behind the times and now feels stale.

McAfee did teach its old dog some new tricks, though nothing that will win it Best in Show. USB and removable drives are now scanned automatically (if you want them to be), it's supposedly better at blocking botnet software from communicating with the mother ship, and a preinstall scan sniffs out malware before McAfee gets fully settled.

Believe it or not, McAfee's greatest strength is its low impact on performance. Our file transfer test took the same amount of time with or without McAfee installed. What's more, McAfee added a mere five seconds to our boot time—impressive! We're also blown away by McAfee's speedy scan engine, which sifted through 35GB in less than 30 seconds on a second pass-through.

Cue the horror music because this is where things turn gruesome. While trotting around the web's dark alleyways, McAfee tried its best to ward away hostile downloads, but was only semi-effective. File after cantankerous file filled up our desktop. As we clicked them, McAfee would often require a reboot to rinse off the scum. Repeated reboots quickly got old, and we still ended up with an infected test bed. After McAfee issued our system a clean bill of health, Malwarebytes detected more than 40 infections, including a MyDoom variant that sabotaged 25 percent of our CPU. That's a problem.

McAfee made big strides in minimizing its impact on system resources, but it's of little benefit if it can't protect our system.

**VERDICT 5**

**McAfee Internet Security 2012**

$80 (1 year, 3 PCs), www.mcafee.com

# ESET
## SMART SECURITY 5
Even the best boxers sometimes lose a round

**ESET HAS FLIRTED** with a Kick Ass award each of the two previous times we reviewed it, and we had high hopes the third time would be the charm. But rather than receive a Kick Ass award, version 5 got its ass kicked by a fake AV virus and a few other pieces of malware. That's unfortunate, because even though ESET has never offered the most features or fastest scan times, we could always count on it to overpower malware.

Things weren't quite as bad as they were with McAfee, and ESET did a much better job at blocking polluted downloads and keeping us away from murky websites. However, the few containments it did let through worked our system over like a schoolyard bully picking on the class nerd. We couldn't access the Task Manager to kill the offending processes, nor were we able to load MSConfig to disable misbehaving apps from loading with Windows. The fake AV program even prevented us from installing third-party software, an underhanded tactic intended to stop users from calling in the cavalry. Our only option was to boot into Safe Mode, but you'd have to be pretty tech savvy to deal with the infections ESET couldn't.

Performance was a mixed bag. ESET didn't impress us with its PCMark 7 or PCMark Vantage scores, yet it added only five seconds to boot and three seconds to our file transfer test. Our test bed didn't feel slow, but if you live and breathe benchmark scores, ESET will leave you winded.

The list of grievances concludes with ESET's clunky interface. It's not terribly difficult to find your way around, but it's just complicated enough to keep less experienced users from making changes. We had high hopes for ESET, but we are ultimately let down by this year's release.




**Don't overpay for security—ESET offers several subscription options, ranging from one to two years for up to five PCs.**

**VERDICT 6**

**ESET Smart Security 5**

$60 (1 year, 1 PC), www.eset.com

# WEBROOT SECUREANYWHERE COMPLETE 2012

Floats like a butterfly and stings malware like a 10-pound hornet

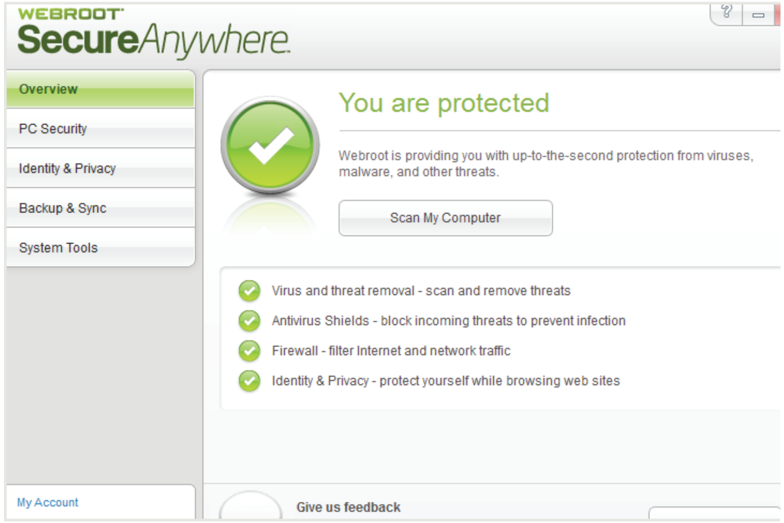
**YOU COULD HEAR** our collective groans from a country mile when Webroot told us its new SecureAnywhere line exists almost entirely in the cloud. Our first thought was, this is going to suck. Webroot proceeded to tell us that SecureAnywhere is like no other antivirus out there: it takes up a fraction of the hard disk space as competing security programs, consumes a minuscule amount of RAM, and can scan a hard drive in seconds, not minutes. All this while still being effective? There's no way, or so we thought. Astonishingly, Webroot undersold its product.

Installing Webroot's flagship SecureAnywhere Complete software took less than five seconds and consumed roughly 50MB of disk space. That's because SecureAnywhere is mostly just a local command hub for Webroot's cloud database where the bulk of the signatures are stored. With an active Internet connection, you're plugged in to a constantly updated "threat intelligence network." Combined with a multilayered heuristics analysis that examines a file's behavior, age, and popularity, SecureAnywhere is able to detect zero-day and even zero-hour threats, at least in theory.

In practice, SecureAnywhere works as advertised. We tested SecureAnywhere using the default settings and watched in surprise as it intercepted a bevy of threats, both locally and on the web. Against all odds, this tiny program towered like a giant. But what happens when you remove the cover of the cloud?

To find out, we disconnected from the Internet and unleashed a flurry of local attacks. As one might predict, SecureAnywhere stumbled, but it didn't wave the white flag. When you're working offline, SecureAnywhere still scans for suspicious activity and is able to block some threats. At the same time, it logs all active processes and tattles to the cloud the next time you're online. If those processes turn out to be malicious, SecureAnywhere gets to work trying to stomp them out by reversing any changes that were made. It wasn't quite as effective in our tests, but how often are you both offline *and* shuttling a bunch of dirty files to your PC?

Extras include a light firewall, cloud backup, a network manager capable of killing offending processes even when you're cut off from the Task Manager, a customizable sandbox, and a whopping 124 settings to tinker with. Oh, and SecureAnywhere doesn't conflict with other AV apps, so feel free to double-up with a free solution if you're paranoid about security. Color us impressed.




**Webroot has its head in the cloud, and that's precisely why SecureAnywhere is so light and effective.**

**VERDICT 9**

**Webroot SecureAnywhere Complete 2012**

$80 (1 year, 3 PCs & 3 mobile), www.webroot.com

Best Practices

## HOW TO AVOID GETTING HIT

The best protection against malware isn't security software, it's you, the user. You should consider antivirus software as your last line of defense, and if you really want to avoid malware—don't we all?—you should steer clear of high-risk situations altogether. Here are some tips.

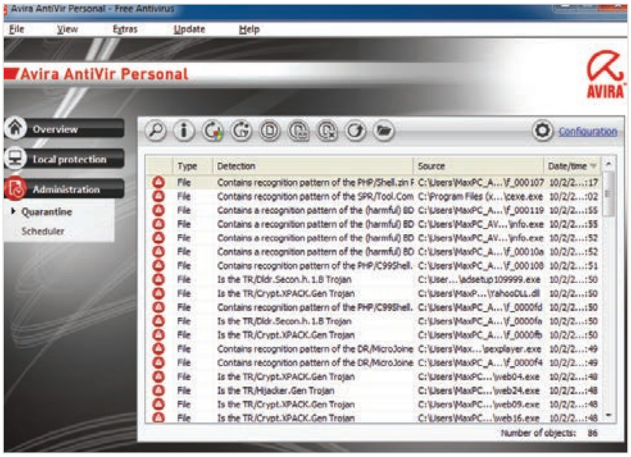
Above all else, keep your software up to date. It starts with Windows but extends to all of your system software, especially programs that connect to the Internet. If you have a lot of programs installed, Secunia PSI (free, bit.ly/DW9u) will sift through them and let you know which ones are out of date. It will even fetch updates for you.

Be extra cautious when connecting to open Wi-Fi networks like the ones you find at coffee shops, airports, and other public places. It doesn't take much effort for a hacker to set up a fake free Wi-Fi hotspot in hopes that you'll connect to his laptop instead of the real hotspot.

Whenever possible, try to avoid using someone else's computer to check your webmail. Can you really trust that their system isn't infected with a keylogger or a screen-capture utility? It just isn't worth the risk. If you simply must, don't forget to log out.

Finally, check the file extension before you open what you think is a JPEG or some other picture format. We've seen dirty executables hide behind picture icons. Right-click and select Properties, or configure Windows to "Show hidden files, folders, and drives" by opening a folder and going to Tools > Folder Options > View.

# AVIRA
## ANTIVIR PERSONAL
Suffocates most malware but isn't quite airtight




**AntiVir recommends disabling Microsoft's Windows Defender to avoid potential conflicts, but we think it's a risk worth taking for the added protection.**

**AVIRA'S ANTIVIR** is a favorite for frugal computer geeks. It's free, it doesn't gorge itself on system resources, and it consistently performs well in front of the big independent testing labs, albeit not all of them. Both Virus Bulletin (www.virusbtn.com) and AV-Comparatives (www.av-comparatives.org) sing high praise for AntiVir's detection rate, but the song coming from AV-Test (www.av-test.org) is less upbeat and tells of AntiVir faltering in the face of zero-day malware attacks. After putting AntiVir through our own battery of tests, we feel compelled to join AV-Test's chorus line.

At first, malware had a tough time slipping past AntiVir. Dirty download after dirty download was swept away. It wasn't until we tried to install a fake AV program that things turned ugly. Rather than stop us from turning our test bed into a pop-up infested mess, Avira blinked, and it was lights out. AntiVir wasn't the only one to fail this portion of our in-house testing, but somewhere along the line, it also let rogue code ensure that our efforts to click URLs from Google searches were redirected. Our verdict is inevitably going to disappoint staunch AntiVir advocates, and while it blocked the majority of threats we threw at it, the two it missed happened to be big ones.

On the plus side, system performance is virtually unaffected with AntiVir installed, save for a slightly longer boot time. There's also a fair number of tweaking options, though digging into the settings feels a little cumbersome. Along with AntiVir's inability to guard against some fake AV software, we wouldn't advise installing it on relatives' machines willy-nilly. Computer-savvy users who plan to supplement AntiVir with smart computing habits and the occasional second opinion from a dedicated anti-spyware program (or two) should be OK. Faults aside, you can't argue with the price.

**VERDICT 6**

**Avira AntiVir Personal**

Free, www.avira.com/free

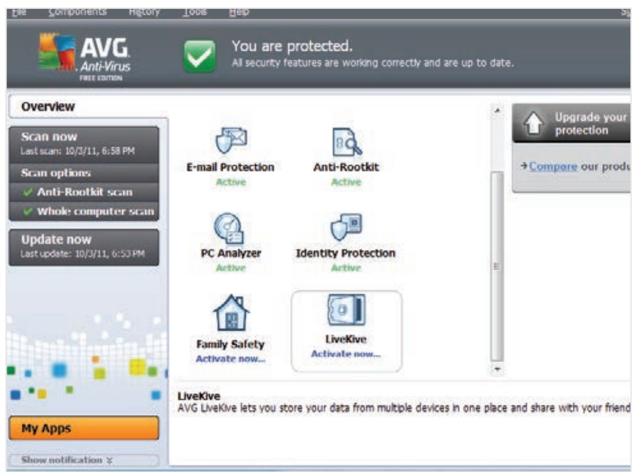
# AVG
## ANTI-VIRUS FREE 2012
The king of free AV is back, baby!

**THE LATEST VERSION** of AVG gets medieval on malware in the same unrelenting manner Duke Nukem hunts down alien scum, only without all the R-rated sound bites (that'd be rad though, wouldn't it? Hold that thought…). Part of the reason it's so effective is because of all the weapons it brings to the fight. This is an exciting trend we're seeing in the free AV field and a marked departure from the days when no-cost security software only provided basic protection.

In this case, AVG hunts down viruses, spyware, Potentially Unwanted Programs (PUPs), rootkits, email-borne threats, suspicious registry entries, boot sector viruses on removable media, and tracking cookies. AVG proved especially skillful at stopping unknown threats dead in their tracks. This is commonly known as behavior-based scanning, though for whatever reason, AVG chose to attach the moniker "Identity Protection" to this component, a peculiar and confusing choice of terminology that we initially thought was referencing some form of built-in ID theft protection. That isn't included here, and neither are many of the extras typically stuffed in a complete security package—things like a firewall or parental controls. We did eventually manage to overwhelm AVG's defenses, so it's still a good idea to seek a second opinion from a dedicated spyware scanner on occasion. This holds true for all three free AV apps included in this roundup.

AVG's dashboard is slightly chaotic, and it doesn't help that it's littered with upgrade offers. An abundance of tweaking options sits beneath the surface (Tools > Advanced settings), some more fleshed-out than others. And those R-rated sound bites you're holding on to? You can attach them to a handful of events via a customizable soundboard. Way cool.

If you're trying to save a few pennies by rolling your own security suite, this is a good place to start.




**Too many of AVG's menus include upgrade offers, marring an otherwise awesome (and free) antivirus program.**

**VERDICT 8**

**AVG Anti-Virus Free 2012**

Free, www.free.avg.com

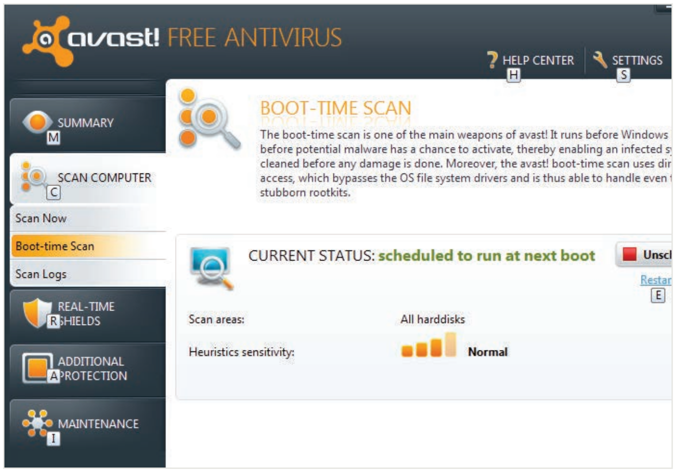
# AVAST
## FREE ANTIVIRUS 6
Better than basic protection without the price tag

**LET'S GET ONE** thing straight: Avast's free antivirus software isn't going to keep your PC squeaky clean if you're determined to run reckless on the web and click every download that comes your way. Few programs can. But where Avast shines is in blocking most bad downloads from reaching the desktop in the first place. In our tests, Avast performed at least as well as some of the full-blown security suites, and in some cases did a better job screening websites.

Avast provides real-time protection against an assortment of malware, not just viruses, through eight configurable so-called "shields" you can fine-tune to your specific setup. Heavy file sharers will want to spend some time polishing the P2P Shield, for example, and there are other shields for instant messaging, email, network activity, and more.

Be careful not to let the sheer number of shields lull you into a false sense of super-security. They weren't strong enough to prevent every piece of malware from penetrating our test bed, though Avast did an above-average job minimizing the damage from unknown threats. One aspect of Avast we really like is that you can choose to have Potentially Unwanted Programs (PUPs) load in a sandboxed environment. By keeping suspicious programs at arm's length of the OS, Avast adds another layer of security. Should that not be enough, Avast also includes a boot-time scanner to scrub out stubborn malware before it has a chance to load and defend itself. This was effective in removing some, but not all, of the infections Avast failed to prevent in real-time.

The notion that you always get what you pay for completely ignores the potential value inherent in free security software. More specifically, it disregards the level of protection that programs like Avast provide gratis, at least when combined with safe computing practices.




**Avast's boot-time scan option helps rid your system of deeply rooted malware by attacking infections before they're able to dig their hooks into Windows.**

**VERDICT 7**

**Avast Free Antivirus 6**
Free, www.avast.com

| AV FEATURE COMPARISON | PANDA | NORTON | KASPERSKY | BITDEFENDER | MCAFEE | ESET | WEBROOT | AVAST | AVIRA | AVG |
|---|---|---|---|---|---|---|---|---|---|---|
| Email Scanning | Y | Y | Y | Y | Y | N | N | Y | N | Y |
| IM Scanning | Y | Y | Y | Y | Y | N | N | Y | N | N |
| Spyware Protection | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Rootkit Protection | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Heuristics | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Firewall | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| Identity Protection | Y | Y | N | Y | N | N | N | N | N | N |
| SPAM Controls | Y | Y | Y | Y | Y | Y | N | N | N | N |
| Parental Controls | Y | Y | Y | Y | Y | Y | N | N | N | N |

| AV PERFORMANCE COMPARISON | PANDA | NORTON | KASPERSKY | BITDEFENDER | MCAFEE | ESET | WEBROOT | AVAST | AVIRA | AVG |
|---|---|---|---|---|---|---|---|---|---|---|
| Scan 1 (min:sec) | 12:48 | 8:7 | 6:34 | 8:26 | 4:56 | 5:44 | 0:47 | 6:54 | 7:09 | 5:19 |
| Scan 2 (min:sec) | 12:14 | 2:40 | 1:18 | 2:14 | 0:28 | 0:27 | 0:10 | 4:36 | 7:31 | 0:59 |
| PCMark 7 | 3,031 | 2,980 | 2,919 | 2,943 | 3,000 | 2,576 | 3,022 | 3,000 | 3,000 | 2,912 |
| PCMark Vantage | 9,017 | 9,070 | 8,789 | 8,607 | 8,598 | 8,126 | 9,004 | 8,896 | 8,986 | 8,947 |
| Boot (sec) | +7 | +16 | +12 | +10 | +5 | +5 | +0 | +9 | +9 | +16 |
| 6GB File Transfer (sec) | +8 | +5 | +3 | +3 | +0 | +3 | +0 | +0 | +0 | +2 |

Our test bed is an Intel Core i7 930, Asus P6X58D Premium, 6GB Corsair DDR3/1333, Radeon HD 5850, Western Digital Caviar Black 1TB 7,200rpm, Windows 7 Professional.

WHITE PAP

BY BILL O'BRIEN

# Bitcoin Digital Currency

An enlightened form of monetary exchange, or refuge for the fiscally paranoid?

Privacy is an elusive goal; in fact, it became unattainable the moment our footprint was added to our birth records and we were stamped on the rump with a Social Security number. Social media sites have gone a long way to convince us that privacy is unimportant in our personal lives, yet we still cling to the notion that we should be able to escape fees, taxes, and other invasions of our monetary lives.

Outwardly stated or not, that was the impetus behind the creation of DigiCash, Flooz, and Beenz—three forms of

> "THE VAST MAJORITY OF BITCOIN OWNERS SIMPLY PURCHASE THE DIGITAL CURRENCY BY VISITING A BITCOIN EXCHANGE, SUCH AS MT. GOX."

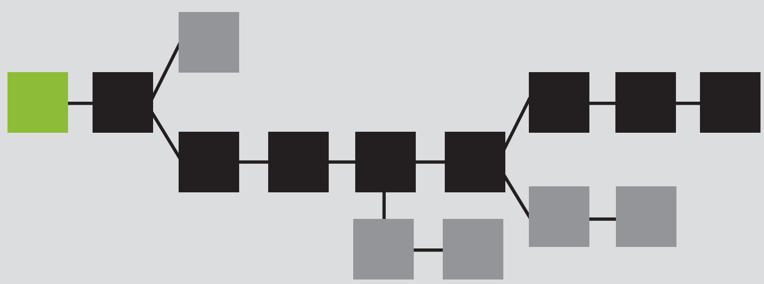
electronic currency that ultimately failed to capture the world's attention. It's also the driving force behind Bitcoin, a peer-to-peer network of currency traders. While there are several exchanges associated with Bitcoin, most notably Mt. Gox (www.mtgox.com), there is no central Bitcoin "bank," nor is there any government agency regulating it. An exchange assists you in buying, selling, or trading your currency; a bank does that, plus it keeps records of your transactions and can act as your proxy in a transaction.

Participating in a Bitcoin economy is rather simple: You first create an e-wallet to hold your Bitcoins; next, you buy or mine for Bitcoins (more on that in a moment) to put in your wallet. You then find a vendor that accepts Bitcoins (the most mentioned products seem to involve Alpaca wool but there are others, including some gambling establishments); initiate a transaction directly with the vendor; have your transaction accepted; and, finally, complete your transaction and receive your goods or services.

Nothing could be simpler, or so it would seem. And without a central bank or financial institution monitoring your transaction, you've eluded the fees associated with wire transfers or checking accounts and—depending on the vendor's relative ethics—you might even have evaded sales and/or any value-added taxes (VAT).

### THE MECHANICS OF BITCOIN

The idea behind Bitcoins was first postulated in 1998 as a form of crypto-currency by a Japanese computer-science student named Satoshi Nakamoto. The idea borrows from the concept that anything used to engage in a transaction (a chicken, a steer, furs, printed paper, and the like) can validly be called currency. Currency, therefore, can be defined as anything fitting that description, including things not necessarily in the physical world. The "crypto" element stems from the concept's objective of not involving even a trusted third party in a financial transac-



**A typical Bitcoin block chain would consist of the genesis block (green) and every transaction block (black) attached to it. While forked blocks (gray) are possible, the only valid chain is that leading from the last transaction block directly to the genesis block.**

# ER




By harnessing the GPU-compute power of multiple high-performance videocards working in concert, a Bitcoin "miner" can help process transactions across the vast peer-to-peer network and earn Bitcoins as a result.

tion. Although such an entity would act as a safeguard for the currency and the activity, it also puts the anonymity of the transaction and the parties involved with it at risk of exposure.

When you download and install your Bitcoin software, it creates a block chain on your computer. The block chain is a compilation of every transaction you've made (starting with the first, or "genesis," block) and is something that is shared across all nodes in the chain. Each block in the chain is created with data from the transaction that spawned it, plus the hash of the immediately preceding block.

In an ideal world, there is but a single path from the current block to the genesis. But it's not an ideal world and there can be forks. A fork occurs if two transactions take place nearly simultaneously. In this case, the only legitimate block chain is the one connected to the genesis block; a forked block will stop before it reaches the genesis.

The nature of the chain provides security: In order to modify any one block after the fact, every block following that one must also be modified, because each one is based on a hash of the block that preceded it. That's an impossible task, according to the Bitcoin algorithm, unless the source of the change (an attacker) wields greater computational power than all the current nodes in the network combined.

### ACQUIRING BITCOINS

To engage in a Bitcoin transaction, you must first acquire some Bitcoins. This can be accomplished either through mining or making a purchase. The vast majority of Bitcoin owners simply purchase the digital currency by visiting a Bitcoin exchange, such as Mt. Gox, and bidding for them. This is a fairly straightforward process: If other members of the exchange are offering to trade Bitcoins at rates of USD 0.93, 0.98, and 1.02, respectively, for example, and you express interest in acquiring 100 Bitcoins at no more than USD 1.00 each, you would win all the Bitcoins up to the number you desire that fall within your price range. If no Bitcoins are available at that price, you could cancel your bid, increase it, or put it on hold until such a transaction becomes possible. The exchange charges a small fee for each trade.

Mining Bitcoins involves being part of the transaction processing system that adds blocks to the block chain. (A transaction isn't completed until the block describing it is processed, and neither the buyer nor the seller can perform that step.) Decoding the block chain, adding the new transaction block, and distributing the new block chain across this very large peer-to-peer network is not something that can be accomplished with an entry-level desktop PC. In fact, Bitcoin mining has transitioned from CPU power to general-purpose GPU power, because the latter can perform the necessary computations as much as 100 times faster. On average, one new block is produced every 10 minutes, and the level of difficulty depends on how many miners are active at a single time. The more there are, the more difficult it is.

As a reward for creating a block (which is the equivalent of beefing up the overall processing power of the network), a miner currently receives 50 Bitcoins plus any fees involved in the transaction. That reward is halved every 210,000 blocks and the total Bitcoin currency will be restricted to about 21 million over the next century.

### THE FUTURE OF BITCOIN

It might seem that Bitcoin is as secure as Fort Knox, but it's not: The Mt. Gox exchange was hacked in June 2011, and the price of Bitcoins traded there dropped from $17 to just pennies in less time than it takes to read about it. The trader whose account was compromised lost $500,000 (you can read about the whole affair at bit.ly/rg2UH9). Fortunately, the dual passwords (one public and one encrypted) that accompany transactions, as well as the multilayered processing approach, render such happenings exceedingly rare. Mt. Gox has also taken steps to improve its security.

Unfortunately, paranoia isn't limited to Bitcoin users. A pair of U.S. Senators recently proclaimed their suspicion that Bitcoins could be used to facilitate the sale of illegal drugs. With comments like that, fear-mongering about Bitcoin-fueled illegal gambling, weapons purchases, and other illicit commerce won't be far behind. And while it would be impossible for any government to prevent Bitcoin transactions from taking place, they could declare them to be illegal. And that would deprive the Bitcoin economy of ever gaining mainstream acceptance. ⏻

# HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

## WINDOWS TIP OF THE MONTH

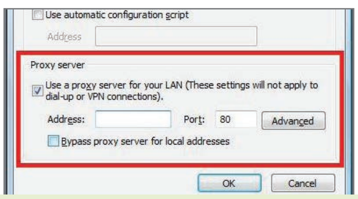



### NEVER FORGET YOUR USB DRIVE

HAVE YOU EVER ACCIDENTALLY LEFT AN IMPORTANT USB KEY STICKING OUT OF THE BACK OF YOUR WORK COMPUTER? HERE'S AN EASY WAY TO MAKE SURE YOU NEVER FORGET AGAIN: USB GUARD.

SIMPLY DOWNLOAD USB GUARD AT BIT.LY/oSOgVN AND PUT THE EXECUTABLE ON YOUR USB DRIVE. RUN IT, AND IT'LL REMIND YOU IF YOU TRY TO SHUT DOWN THE SYSTEM WITHOUT REMOVING THE KEY.

## MAKE - USE - CREATE











ALEX CASTLE
**ONLINE MANAGING EDITOR**

## WHERE'S THE LINE?

**WE RECENTLY** were contacted by a company requesting that we remove one of my old how-to projects from MaximumPC.com. The reason? The company had legal disputes with the maker of the software that facilitates the project. We declined to take down the article, but the whole thing got me thinking: Where's the line?

A lot of my favorite how-to articles involve some form of hacking. When I built a multitouch surface computer, I had to hack a PlayStation 3 web camera to do it (bit.ly/13xyU1). The MAME machine, of course, presented a whole different legal quandary (bit.ly/nkxs8m). In this very issue, there's a how-to about circumventing barriers that keep you from legally watching a movie from a different country. So where's the line between breaking the law and DIY or Maker culture? I don't have the answer, but if you do, I'd love to hear it—send your thoughts to comments@maximumpc.com.

↘ submit your How To project idea to: comments@maximumpc.com

# ACCESS REGION-LOCKED CONTENT ONLINE –Brad Chacos

We may call it the World Wide Web, but that doesn't mean you can view every website's content all around the globe. Many of the big-name content providers—like Steam, Netflix, Pandora, and BBC—employ region locks to limit their services to specific countries. But this is the Internet we're talking about, so naturally, there are ways around the roadblocks.

A few notes before we begin: The solutions offered below aren't perfect. Surfing speeds are usually slow, content providers sometimes restrict access from certain proxies and VPNs, and you often have to pay proxy owners for access to streaming content. Got it? Good—let's go spoofing!

**1 PROXIES** The easiest way to bypass many region locks is by using free "High Anonymous" proxy servers, which don't identify themselves as proxies when connecting to websites; find them by searching proxy aggregators like www.proxy.org or running a quick Google search for "[country name] free proxy". Most free proxies don't allow streaming, however, so you'll have to do some digging. FoxyProxy (www.getfoxyproxy.org) offers access to high-speed proxies in countries around the world, but you have to pay for access.

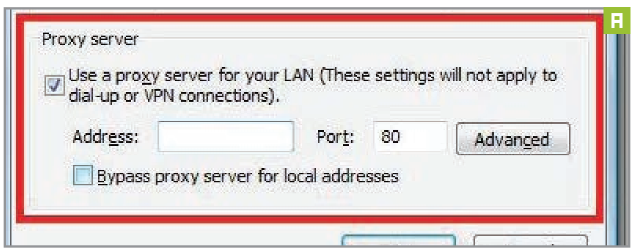
» A lot of proxies use an in-browser interface to get the obscuring job done, but others require you to manually tweak your browser's proxy server settings. Here's how to do it.

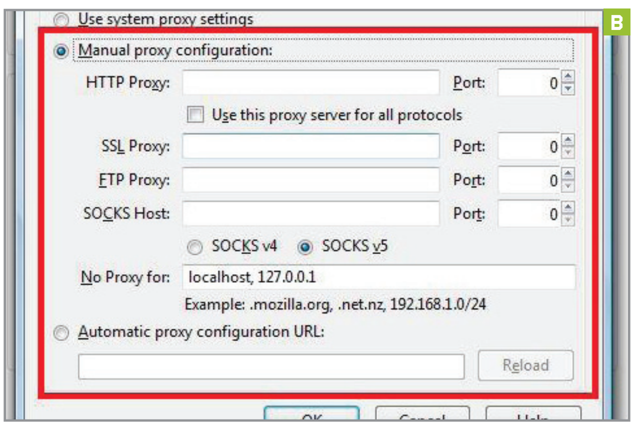
### INTERNET EXPLORER

Click the gear icon in the upper right-hand corner and then click Internet options; in the Connections tab, select Lan Settings. Check the box next to "Use a proxy server..." and enter the proxy's info in the Address and Port fields. If the server uses additional settings, click the Advanced button to input them **(image A)**.

### FIREFOX

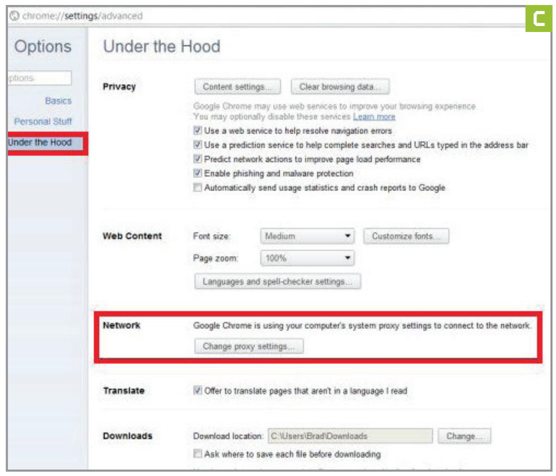
Click the Firefox button > Options > Options; go to the Advanced tab, then the Network tab, and hit the Settings button. Select "Manual proxy configuration" and enter the information provided by your proxy server **(image B)**.




### CHROME

To access the proxy settings, click the wrench icon, go to Options, then Under the Hood, then Network **(image C)**.




**2 VPNS** Virtual private networks often offer better region-cracking success than free proxies, but if you want to stream content, you usually have to pay for a premium VPN service. UltraVPN (www.ultravpn.fr) and HotSpot Shield (www.hotspotshield.com) are two free VPN services that allow U.S.-based streaming, but major services like Hulu and Netflix often block access by those sites' servers. Make sure that whatever VPN you choose offers IP addresses for the country you want to access content from.

» Many VPNs use stand-alone applications that you simply activate and log in to. Others may ask you to connect manually. Here's how to do just that in Windows 7/ Vista:

» Click Control Panel > Network and Sharing Center; select "Set up a connection or network" and then "Connect to a workplace." Click Next. If prompted, click "No, I'll create a new connection." Connect via "Use my Internet connection," and enter a name and the address provided to you by your VPN. Afterwards, connect to the VPN by selecting it from the network icon in the system tray. You'll need to enter your supplied username and password to access the VPN.

# GET STARTED WITH THE WINDOWS 8 DEVELOPER PREVIEW –Tim Ferrill

> "GIVE THE PLATFORM A TRIAL RUN"

**WITH WINDOWS 8**, Microsoft is reimagining the most basic premises of personal computers. CEO Steve Ballmer recognizes the drastic changes coming in Windows 8, even calling the platform one of the biggest risks taken by the industry giant. The UI changes and fundamental paradigm shifts that Windows 8 brings to the table are making a lot of power users eager to give the platform a trial run, even in its current state as a Developer Preview.

» If you want to take the plunge and give Windows 8 a try, there are some things you should know ahead of time. First, the current build of Windows 8 is intended as a Developer Preview. This is pre-beta software, meaning there will be bugs and even major missing features. We don't recommend installing Windows 8 as your primary system, but we do encourage you to take it for a spin and spend some time tinkering under the hood. And we recommend that you use good backup practices for any data you put on your Windows 8 system, as stability may be an issue.

## 1 PREPARE TO INSTALL

Whenever you are looking to install new software, especially a new operating system, your first step should be to review the system requirements.

» Fortunately, the system requirements for Windows 8 are identical to those for Windows 7. In fact, a baseline Windows 8 installation will consume fewer system resources than a baseline Windows 7 SP1 build. So if you're already running Windows 7, you're in good shape. Note, however, that there are special requirements for touch input.

» Microsoft has provided both 32-bit and 64-bit versions of the Windows 8 Developer Preview installation media, both freely available from MSDN at bit.ly/r8eqO3. For best results, you should verify that your media downloaded correctly using the hash provided by Microsoft. The .iso files provided can be easily burned to a DVD using native tools in Windows 7 or your preferred DVD software.

## 2 INSTALL

There are a couple of different decisions that must be made before you begin any OS install. The first is whether you want the OS to coexist with another in a dual-boot scenario or if you are simply going to overwrite any existing OS installs. Dual-booting provides you with some flexibility to fall back to an existing platform, but also adds complexity in terms of drive partitioning. The other decision is the method of installation. The typical method for installing an operating system is using a bootable disc, which gives you the ability to install the Windows 8 OS to a second hard drive or partition. The Windows 8 Developer Preview will also allow you to install from within a previous Windows version, providing you the option to retain accounts, files, and settings (if installing from Vista or Windows 7). We'll walk you through both options.

» The most common method for installing a new operating system on your computer is to boot from a setup disc, in this case a DVD. After inserting the disc and choosing to boot from your optical drive, the Windows 8 setup wizard will look very similar to the Windows 7 install. The first screen prompts you to enter your location information in order to configure your keyboard and other locale-specific settings **(image H)**, and the second contains the button to actually begin the installation.

» As with most Windows installations, Windows 8 displays Upgrade or Custom (advanced) options. One of the key differences in using the boot-disc installation is that the Upgrade choice is actually a dead-end. To upgrade from a previous install of Windows, you'll need to use the Windows-based setup utility.

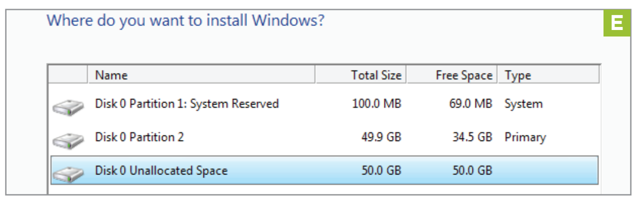
» The next step in this exercise is choosing the drive or partition for your Windows 8 install **(image E)**. As with Windows 7, you have the option to use empty drive space, reformat an existing partition, or install over an existing Windows instance. If you choose the latter option, system and user files will be placed in the Windows.old directory to be accessed later. Choose your option and hit next—the installer will take over from there.

### ALTERNATIVE: SETUP FROM WINDOWS

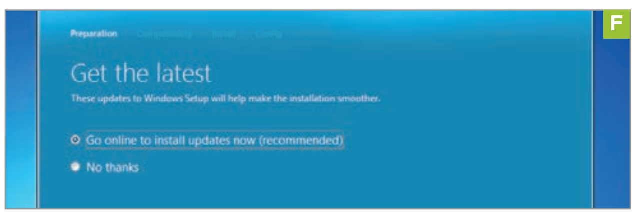
Using the Setup option from within a previous version of Windows is a relatively simple prospect. After inserting the setup disc, the installer will ask if you'd like to get updates to the installer itself, which is a nice benefit **(image F)**. You'll be asked a couple of simple questions—click the Install button at the end and setup will proceed. Once installation is complete, you will be prompted to configure Windows 8 for the first time.




D




E



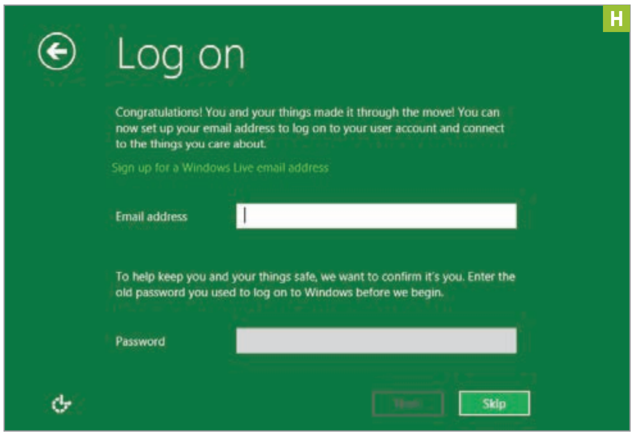

F

**3** **INITIAL CONFIGURATION** Once you've successfully completed the install of the Windows 8 Developer Preview, there are still some configuration steps to take before you can start playing around with the system **(image G)**. If you're the impatient type, the "Use express settings" button is your shortcut to the end result. We recommend choosing the Customize option, which allows you to step through each setting and verify that your machine is configured perfectly.

» Assuming you chose the Customize button, the next screen you see asks for your sharing settings—basically, whether you want to share files or devices with other computers on your network. The next screen allows you to configure settings for automatic updates and system protection tools like SmartScreen Filter in Internet Explorer. The rest of the configuration process is fairly self-explanatory.

» Now that the system is configured, it's time to get your account set up. There are a couple of options at this point that require some attention. Windows 8 will allow you to use local computer accounts, just like prior versions of Windows, or you can log in with your Windows Live account **(image H)**. Using the Windows Live option will give you some additional features, like the ability to synchronize files and settings between multiple Windows 8 computers. If you used the Windows-based setup and selected the option to retain your user account information, you will be required to enter your old password in order to complete that process. Associating your existing account with Windows Live is completely optional, but if you forgo this choice you will miss out on some of the key new functionality in Windows 8.










**4** **TRY IT OUT** Now that you've successfully navigated the installation process, it's time to play with the shiny new Metro UI. Resist the urge to jump straight to the Windows Desktop—Metro is the future of Windows **(image I)**. Though the UI is designed to be extremely touch friendly, Microsoft has made an effort to make it usable for users with a mouse and keyboard, as well. You can activate Metro apps with a mouse click, rearrange tiles by clicking and dragging, and search by simply typing a word or phrase.

» There are a few common gestures you should become familiar with. Placing your mouse in the bottom-left corner of the screen will access the "Charm" menu **(image J)**, which gives you quick access to Search, Settings, and Sharing. Placing your mouse on the far left edge of the screen will bring up a thumbnail of the last app you used. Clicking this thumbnail will return you to the app.

» OK, the training wheels are off and you're on your own. Enjoy the ride!

# BUILD IT

NATHAN EDWARDS **SENIOR ASSOCIATE EDITOR**



## Why Not Go All-Out with WHS?

I'm tired of arcane web interfaces and sluggish CPUs on my network storage. It's time to build a Windows Home Server with enough capacity for all my data and enough power to flawlessly stream HD video.

LENGTH OF TIME: **4 HOURS** (Not counting RAID installation) | LEVEL OF DIFFICULTY: **INTERMEDIATE**

**THE MISSION** Despite Microsoft's apparent lack of love for Windows Home Server 2011—the company stripped Drive Extender from the final version, and good luck finding a retail Windows Home Server 2011 box in the U.S.—it's still a great server OS for a Windows-heavy home environment. Backups are effortless, streaming is hassle-free, it's easy to administer, and there are tons of add-ins available.

Given a choice between buying an off-the-shelf product and building one myself, I'll opt for the build any day. And since you can't *get* a retail WHS box in the U.S. anyway, I figured what the heck. I pinged Michael Brown, our home network guru, for advice, and together we spec'd out a Home Server Dream Machine, with a real CPU to handle on-the-fly transcoding and all the storage you can eat. No, you can't buy a home server this nice *anywhere*. But if you like what you see, you can build one , too.



Fractal Design's Array chassis is a sleek and attractive home for my Home Server.

### INGREDIENTS

| PART/URL | PRICE |
|---|---|
| **CPU** Intel Core i5-2405S<br>www.intel.com | $220 |
| **Motherboard** Gigabyte GA-H67N-USB3-B3<br>www.gigabyte.us | $115 |
| **Memory** 4GB Corsair CMV4GX3M2A1333C<br>www.corsair.com | $30 |
| **RAID controller** HighPoint RocketRaid 2720SGL<br>www.highpoint-tech.com | $145 |
| **RAID cables** HighPoint Int-MS-1M4S (x2)<br>www.highpoint-tech.com | $30 |
| **Enclosure** Fractal Designs Array R2 Mini-ITX<br>www.fractal-design.com | $190 |
| **Storage** Seagate Barracuda XT 3TB (x5)<br>www.seagate.com | $900 |
| **OS storage** Seagate Barracuda XT 1TB<br>www.seagate.com | $80 |
| **OS** Windows Home Server 2011<br>www.microsoft.com | $60 |
| **TOTAL** | **$1,770** |

# Building the Perfect Server

**A HOME SERVER** is a different animal from a standard rig. Since they're designed to run headless, you don't need a monitor, keyboard, or mouse, except for the initial setup. Administration thereafter can be done remotely. You also don't need a discrete videocard. What do you need? A decent CPU and RAM, a boatload of hard drives, and the means to run them.

Most off-the-shelf home servers ship with anemic Atom or ARM processors. I don't play that way. Intel's Core i5-2405S offers a quad-core 2.5GHz Sandy Bridge CPU with low power consumption and heat output. Its onboard video is nothing fancy, but good enough for the rare instances I'll need to use it.

For my motherboard, I chose Gigabyte's GA-H67-USB3-B3. The H67 chipset lets me use the CPU's onboard graphics when I need to, its Mini-ITX form factor is perfect for a home server, and it's inexpensive. It also has 6Gb/s SATA, which will be useful for the boot drive, and USB 3.0, in case I need to plug in additional external storage.

Fractal's Array R2 chassis was an obvious choice for this WHS build. It's beautiful, has a built-in 300W PSU with six SATA power leads, and has a drive tray that can hold up to six 3.5-inch hard drives.

The most important part of this build, of course, is the storage. Windows Home Server needs at least 160GB for its install partition, so I picked a 1TB boot drive because they're not much more expensive than smaller-capacity drives. Because this server will hold backups of all my computers, as well as movies, music, and family photos, redundancy is important. Windows Home Server doesn't have native data redundancy or RAID support, so I had to roll my own. HighPoint's RocketRaid 2720SGL is a PCIe RAID card that supports up to eight SATA or SAS drives at 6Gb/s. I'm pairing it with five 3TB Seagate Barracuda XT drives.

## ASSEMBLING THE HARDWARE

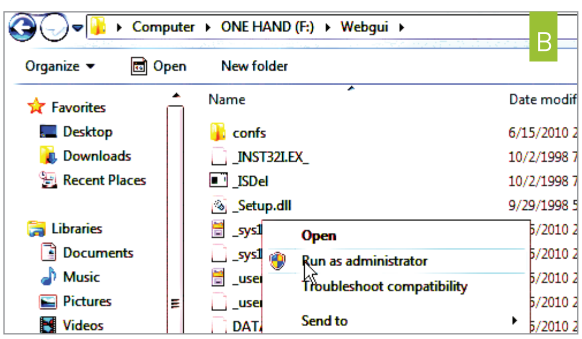
Building the box was the easy part. The Fractal case is roomy and—once you remove the hard drive cage—easy to build into. I just mounted the CPU to the motherboard and installed the stock fan and RAM, then installed the motherboard and I/O shield into the case. The RAID card slots into the motherboard's solitary PCIe connector and fits into one of the case's two PCIe expansion slots. I secured the six hard drives into the hard drive cage with four screws each, then plugged the 1TB boot drive into one of the motherboard's 6Gb/s SATA ports with one of the mobo's included SATA cables, and the five 3TB drives into the HighPoint RAID card via the mini-SAS-to-SATA cable adapters.

Since the build doesn't include an optical drive, I had to connect a USB optical drive in order to install Windows Home Server, the motherboard drivers, and the RAID software. If you don't have an optical drive, you can snag one for around $30, or you can use ImgBurn (www.imgburn.com) on your PC to create a disk image of your WHS install DVD, and use Microsoft's Windows 7 USB/DVD Download Tool (bit.ly/plrAPM) to make a bootable USB drive.

## CONFIGURING THE SOFTWARE




If you've ever installed Windows 7, you know how to install WHS. Pick your language, select the primary hard drive (remember, we're installing onto the 1TB drive, not the 3TB drives), and go make a pizza or something. In about 20 minutes, the installer will let you know that it can't find a network driver **(image A)**. Insert the motherboard's driver disc, then open Device Manager and navigate to Other Devices. Right-click the Network Adapter and select Update Driver Software, then "Browse my computer for driver software". Navigate to your optical drive directory, then Network, then RLT8111. Select "include subdirectories." Your driver should install and prompt you to restart. Then the Home Server installer will continue configuring, before asking you to set the system time. Sync the time to the Internet and move on.




## INSTALLING THE RAID CARD

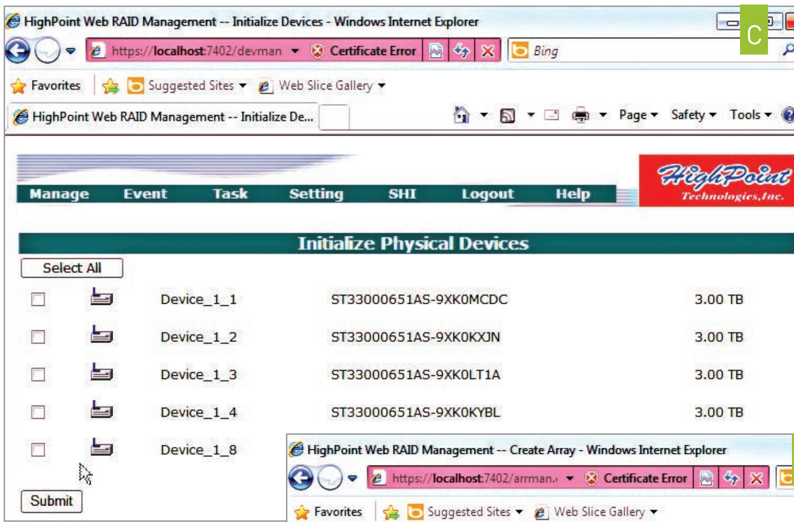
Soon you'll be presented with a familiar-looking desktop and a prompt to install device driver software for your RAID card. If you don't see the prompt, right-click the RAID card entry in Device Manager. Download the most recent Windows Vista/2008/7 drivers, as well as the WebGUI installer, from bit.ly/qgKOkc, extract the driver, zip to your desktop, and, following the same procedures as above, navigate to the x64 folder and let the device driver install. Reboot.

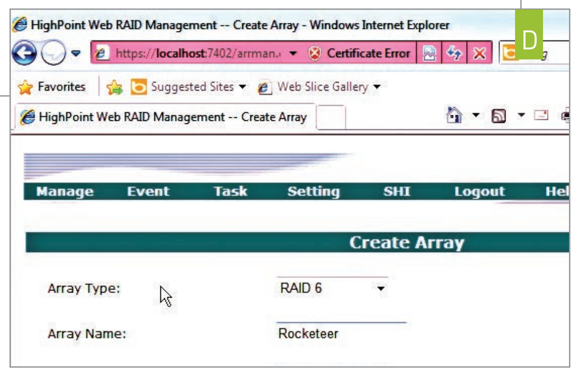
Extract the WebGUI folder, right-click Setup.exe, and select Run as Administrator **(image B)**. Follow the prompts to install it, then click the WebGUI shortcut on the desktop. Login using the username and password you got during install (default: RAID/hpt).

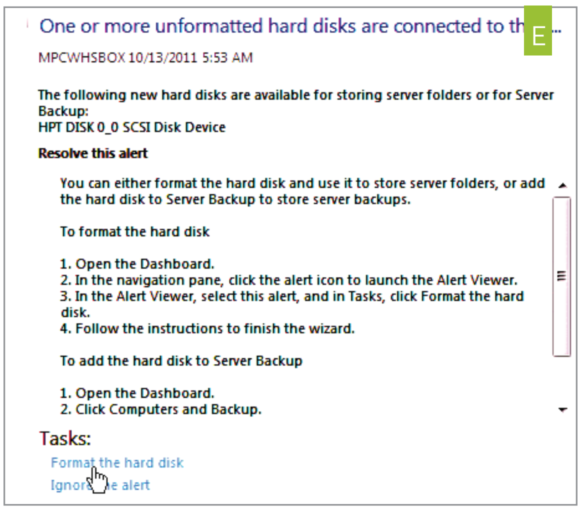
## CREATING THE RAID

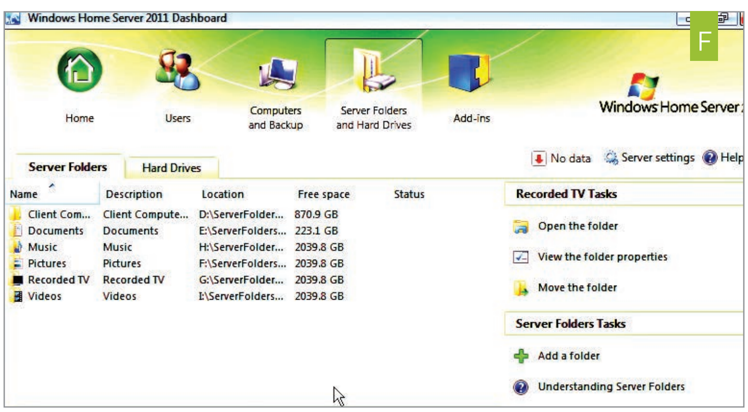
Navigate to Manage > Drives, and select Initialize Drives. You should see all five 3TB drives listed **(image C)**. Select them all and hit Submit. Then go to Manage > Array, and select Create Array. Select all the drives and hit Submit. Now you have to choose a RAID level **(image D)**. Since this is home backup, redundancy is important. I opted for RAID 6. RAID 6 is similar to RAID 5, except it uses two parity volumes, so it can tolerate failure of up to two drives without losing data. RAID 5 would have given us 12TB of usable space instead of the 9TB that RAID 6 gave us (out of 15TB total), but I felt the additional redundancy was worth it. Select Foreground initialization, Write Back cache policy, and 64KB block size. Create the maximum size RAID you can.

It's very important that you select the 4K sector size instead of the default 512B; otherwise Windows won't be able to see the whole 9TB array. Click Create. Now go away for about seven hours while the RAID builds. When you come back, verify that the RAID creation was successful, then you can go to the Dashboard.



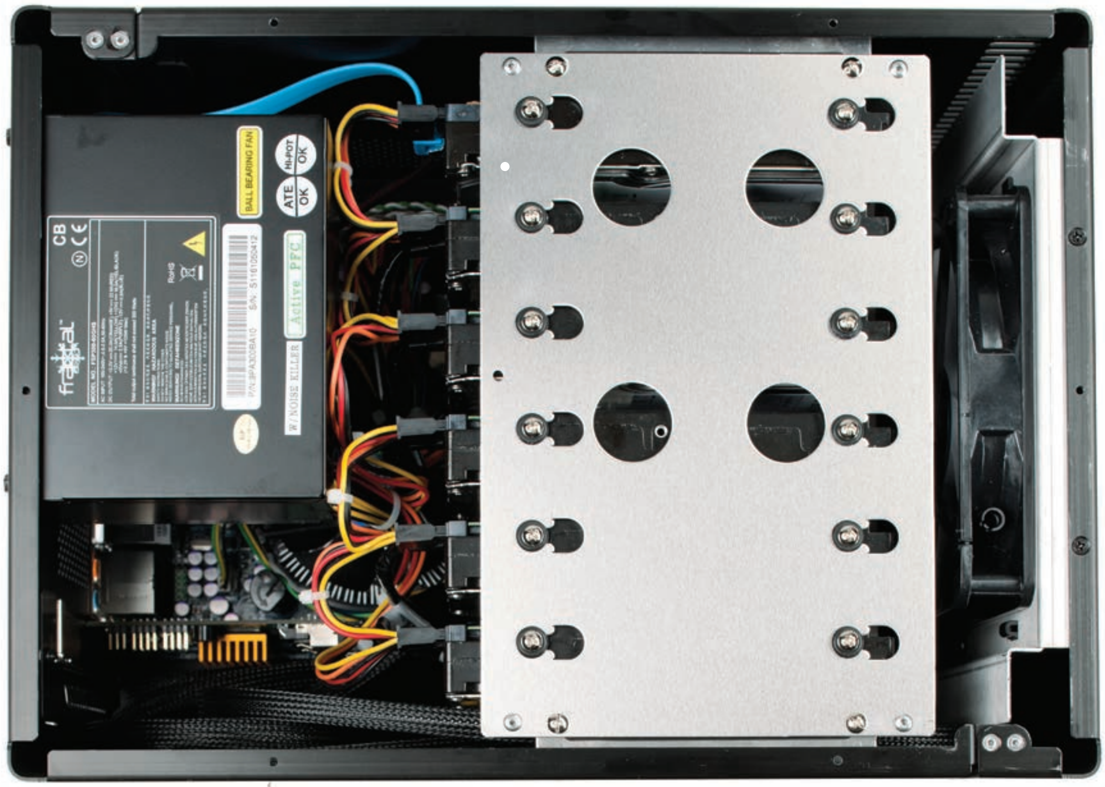




## MOVING THE SHARES

Click Event Viewer, which should tell you that, hey, you have an unformatted hard disk available! Select "Format the hard disk" **(image E)** and you'll see the 9TB (well, 8,393GB) array you just created. Format it! Now, here's where it gets a little weird. Because WHS uses the .vhd virtual hard drive format for backing up, you can't actually create a volume larger than 2,040GB. Therefore, your 8,393GB array is now four 2,040GB partitions plus a 2,23GB partition. That's fine with me, as it provides a convenient way to categorize my shares.

Click "Server Folders and Hard Drives" in the Dashboard. You'll see folders for backups, documents, music, pictures, and video shares. I used the "Move the folder" command to assign each to a different partition, just to be fancy **(image F)**.

Now you have a Windows Home Server! From here, you can connect to your home server from each of your home computers to set up backup and remote administration. Feel free to disconnect your monitor, keyboard, and mouse now, and do the rest of your administration and configuration remotely. Just navigate to http://[your server's name]/Connect from any of your home computers to download the Home Server Connect software.



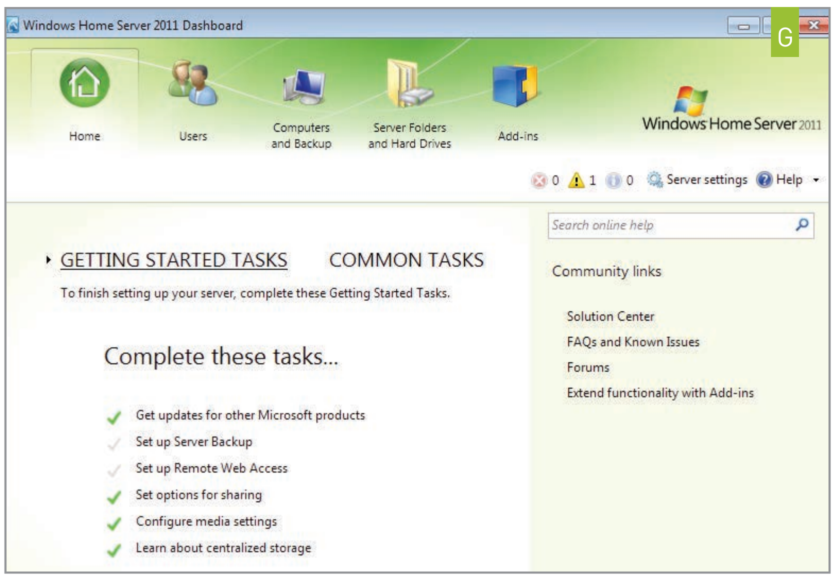
The server's six hard drives are positioned right in front of its 14cm intake fan, so they get the cool air first.

# Serving up Awesome

**PROPERLY CONFIGURED,** a Windows Home Server is a joy to own because it hooks in so well to the rest of the Windows ecosystem. It's easy to set up server-side backups of your home computers, designate per-user or HomeGroup read/write access, and configure media streaming options and remote web access, all from within the Dashboard on your PC **(image G)**.

With 9TB of storage, my Windows Home Server offers plenty of space to back up my home computers and serve as the central repository for all my media. Add-ins can offer additional functionality; for tips on good add-ins I like the community site WeGotServed.com.

If this Home Server build seems like overkill to you, there are a number of ways to lower the price. If you don't need two-disk redundancy, you can go from RAID 6 to RAID 5; this will let you go from five disks to four while still tolerating single-drive failures. Or you could save $170 by eliminating the RAID card and cables altogether, and just use the SATA ports on the motherboard. You'll be limited to four drives, and you'll lose the hardware RAID options, but Windows




Home Server doesn't require RAID, and given the 2TB limit on its virtual volumes, you might prefer independent disks anyway.

Windows Home Server is a lot easier to configure than was FreeNAS 7 the last time I took a look at it. I'll be taking a look at FreeNAS 8.1 when it arrives, but this build has me convinced that the $60 for Windows Home Server 2011 is well worth the price, especially if you have a Windows-centric home.

# REVIEWS

TESTED. REVIEWED. VERDICTIZED.

## INSIDE






SAMSUNG 830 SERIES SSD
PAGE 81

# Digital Storm Black Ops HailStorm

## All hail the HailStorm!

**WE'LL BE THE FIRST** to admit that system benchmarking has gotten downright boring in the last couple of years. It's been a solid year and a half of Core i7-980X/990X procs followed by a year of Core i7-2600K rigs. Yawn, seen it.

We certainly can't say that about Digital Storm's latest Black Ops HailStorm. It's the first machine to grace our Lab with Intel's Core i7-3960X (see the details about Sandy Bridge-E on page 26), so we were anxious to see if the new chip could actually walk the walk. We know from our testing of the chip in a controlled environment that it's a bad mother, but what about when it's in a high-end system and it's being run against a slew of other super-fast rigs?

The short answer is, it does pretty damn well. In fact, the Black Ops HailStorm actually set three new benchmark records and tied a forth.

Details about the HailStorm's config are laid out in our spec chart, but the highlights include Asus's P9X79 Deluxe board and a custom dual-loop liquid-cooling system, which cools not just the CPU but also the tri-SLI setup of GTX 580 cards. The case is a modified version of Corsair's 800D that's been custom-painted with Digital Storm's "Black Smoke."

But the real story is the CPU, right? Digital Storm had hoped to send the chip to us with the company's custom Cry-TEC thermo-electric cooler but couldn't get the mounts for the new Intel LGA2011 socket in time. So, with "just" the liquid cooler, the company took the box to 4.7GHz, or about 1.4GHz over stock. That's certainly not as big a feat as we've seen with some Sandy Bridge chips, but this chip has two more cores, and to be fair, people are just starting to get to know it and how well it overclocks.

At that clock speed, the Core i7-3960X doesn't disappoint. We've seen everything from 4.7GHz Core i7-980X boxes to 5.5GHz Core-i7-2600K machines. At 4.7GHz, the Black Ops HailStorm has some legs. The fastest machine we've seen in our Sony Vegas Benchmark is Velocity Micro's Raptor Signature from the May issue. Equipped with a Core i7-990X at 4.7GHz, it's scary-fast. But with its 32 percent faster score, the HailStorm is Jason-standing-in-your-closet-at-midnight terrifying. The HailStorm also set records in our ProShow encode, MainConcept Reference test, and Far Cry 2 benches.

We also have been keeping an unofficial tally of how the recent machines have been performing in the DX11 Unigine test, and the tri-SLI 580 gives us about 50.8fps. That's pretty much what other tri-SLI and quad-SLI rigs have spit out.




**Performance isn't free, and the Black Ops HailStorm proves it.**

The truth is that even with this much CPU firepower, when it comes to modern games at high resolutions, it's still 95 percent about the GPU.

So what's bad here? The price. The Digital Storm tips the scale to the breaking point at $7,369. Much of that comes from the pricey new chip, custom liquid cooler, custom paint job, and, well, what you have to pay to get the absolute latest and greatest in gaming hardware. But then, what do you expect from a box that can walk in and outperform just about every machine we've tested this year? –GORDON MAH UNG

**VERDICT 9 KICK ASS!**

**Digital Storm Black Ops HailStorm**

**NAIL** Record-breaking performance.

**FAIL** Near record-breaking price, too.

$7,640, www.digitalstormonline.com

### BENCHMARKS

| | ZERO POINT | |
|---|---|---|
| Vegas Pro (sec) | 3,049 | 1,651 |
| Lightroom 2.6 (sec) | 356 | 241 |
| ProShow 4 (sec) | 1,112 | 755 |
| Reference 1.6 (sec) | 2,113 | 1,227 |
| Stalker: CoP (fps) | 42 | 124.8 (+197%) |
| Far Cry 2 (fps) | 114.4 | 217 |

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1,750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and the 64-bit version of Windows 7 Ultimate.

### SPECIFICATIONS

| | |
|---|---|
| Processor | 3.3GHz Core i7-3960X OC'd to 4.7GHz |
| Mobo | Asus P9X79 Deluxe |
| RAM | 16GB DDR3/1600 |
| Videocard | Three EVGA GeForce GTX 580 in tri-SLI |
| Soundcard | Onboard |
| Storage | Two Corsair Force GT in RAID 0, two 2TB WD 7,200 rpm HDD |
| Optical | LG Blu-ray burner, DVD burner |
| Case/PSU | Custom Corsair 800D/ Corsair 1200 |

# Samsung 830 Series SSD

## Stylish, screaming fast, and slim

**SAMSUNG IS KIND OF** a big deal. In addition to manufacturing everything from tablets to televisions to turbines, the Korean giant is one of the world's largest producers of DRAM and NAND flash memory, and it has long provided SSDs to OEMs and systems integrators. Samsung entered the retail SSD market in late 2010, with its 470 Series SSD delivering performance on par with the first-gen SandForce drives that owned the top end of the market. It's now late 2011, and the goalposts have shifted. Samsung's Series 830 drive boasts a slimmer look, a refreshed controller, and a 6Gb/s SATA interface. Can the new part compete with today's top SSDs?

Like the Series 470 SSD, the Series 830 is top-to-bottom Samsung, from the 20nm toggle NAND, to the 256MB of DDR2 cache, to the tri-core ARM processor controlling the drive. Samsung tells us the three-core design allowed them to dedicate one core to full-time garbage collection. The controller is similar to the one on the Series 470, but the Series 830 brings much-needed 6Gb/s SATA support.

And boy, does it cook. The 256GB Series 830 SSD we tested matched the fastest second-gen SandForce drives, such as OCZ's Vertex 3, in nearly every benchmark, and it exceeded them in some. The 830 Series' sustained read speeds stayed north of 500MB/s, with sustained writes averaging 388MB/s or 398MB/s, depending on the benchmark—that's more than 100MB/s faster than the SandForce drives we've tested. The 830 Series' 4KB single-queue-depth read and write speeds are as high as the Vertex 3's, while 32QD reads far surpass the Vertex 3's. Writes at 32QD however, lag at 150MB/s to the Vertex 3's 247MB/s. In fact, high-queue-depth 4KB random writes are the only test in which the Vertex 3 (and its SandForce brethren) beat the pants off the Samsung 830 Series. In our 32QD Iometer random-write test, the Vertex 3's IOPS were three times higher than the Samsung's. On the other hand, the 830 Series edged out the competition in our Premiere Pro video-encoding test, which writes a continuous uncompressed 20GB .avi video to the disk, and its PCMark Vantage and PCMark 7 storage subscores were top of the pack.

The 830 Series SSD is as attractive as it is fast, with a black brushed-aluminum finish and a chassis that's just 7mm thick to fit inside the thinnest of notebooks. It's also well equipped with extras. The SSD is available in three different configurations: as a bare drive, in a laptop kit, and in a desktop kit. All three include a full version of Norton Ghost, while the laptop kit includes a SATA-to-USB adapter and a spacer, so the drive fits in standard 9.5mm drive bays. The desktop version includes a 2.5-inch-to-3.5-inch tray adapter.

The 830 Series SSD can't match the high-queue-depth random writes of a SandForce-powered drive, but it's as good or better than the competition at everything else, with especially impressive sustained write speeds. The 830 Series SSD is a serious ass-kicker that demonstrates Samsung's vertical integration to be a concrete advantage over the competition.
**–NATHAN EDWARDS**




**The 830 Series SSD is just 7mm thick, so Samsung provides a spacer in its laptop upgrade kit.**

### BENCHMARKS

| | Samsung 830 Series SSD | Samsung 470 Series SSD | OCZ Vertex 3 | OCZ Agility 3 |
|---|---|---|---|---|
| Capacity | 256GB | 256GB | 240GB | 240GB |
| CrystalDiskMark | | | | |
| Sustained Read (MB/s) | **506.4** | 261.3 | 485.5 | 213.8 |
| Sustained Write (MB/s) | **398.5** | 255.3 | 289.8 | 248.8 |
| AS SSD | | | | |
| Seq. Read (MB/s) | 502.6 | 236.4 | **506.2** | 211.6 |
| Seq. Write (MB/s) | **388.1** | 245.2 | 280.2 | 237.4 |
| 4KB Read (IOPS) | 5,513 | 2,828 | **5,539** | 4,782 |
| 4KB Write (IOPS) | **14,412** | 11,336 | 14,263 | 12,767 |
| ATTO | | | | |
| 64KB File Read (MB/s) | 405.85 | 250.85 | **505.38** | 422.81 |
| 64KB File Write (MB/s) | **515.05** | 255.12 | 446.47 | 479.53 |
| Iometer | | | | |
| 4KB Random Write, 32QD (IOPS) | 35,329.48 | 18,166.03 | 85,144.43 | **90,267.67** |
| Max Access Time (ms) | **31** | 33 | 61 | 57 |
| Premiere Pro Encode/Write (sec) | **420** | 423 | 426 | 426 |
| PCMark Vantage x64 HDD | **62,168** | 36,508 | 59,978 | 61,403 |
| PCMark 11 x64 Secondary Storage Test | 5,257 | 4,631 | **5,285** | 4,859 |

Best scores bolded. Our current test bed is a 3.1GHz Core i3-2100 processor on an Asus P8 P67 Pro (B3 chipset) running Windows 7 Professional 64-bit. All tests used onboard 6Gb/s SATA ports with the latest Intel drivers.

VERDICT **9** KICK ASS!

**Samsung 830 Series SSD**

**+ 8:30 PM** Blazing fast, especially in sustained writes; sleek and attractive; comes with a full copy of Norton Ghost.

**– 8:30 AM** Can't match SandForce for 4K random IOPS.

$429, www.samsung.com

# Toshiba Qosmio F755

## A glasses-free 3D laptop




The webcam in Toshiba's F755 tracks the position of a user's eyes to create a convincing 3D image without the need for stereoscopic glasses.

**WE HAVE A TERM FOR** technology like Toshiba's Qosmio F755 laptop. It's "demo cool." It wows you in a demo, but after some serious testing, you're not quite sure you'd want to use it day in and day out. Though we're impressed by the technical achievement of Toshiba's glasses-free 3D technology, it's just not developed enough to earn our recommendation.

Unlike most stereoscopic 3D displays, which require you to wear a pair of 3D glasses, Toshiba's lenticular display creates a stereoscopic 3D illusion with the naked eye. That illusion did impress us. Watching a 3D Blu-ray video of an aquarium, you are almost fooled into believing there are fish swimming around in the laptop. This technology works both in a window and full-screen, promising to integrate 3D into a normal part of the PC-using experience.

There are, however, some downsides to a glasses-free 3D display. To maximize the effect, the laptop uses the webcam to track your head movements. We found that the 3D effect was best if one person watched the video, sitting right in front of the laptop, and keeping his or her head completely still. Head movement or an oblique viewing angle significantly reduced or disrupted the 3D effect. We also found the display slightly grainy, looking like there was a faint grid overlaying the screen, even when using the laptop for non-3D purposes. In addition, we experienced some eye strain after prolonged 3D viewing.

The biggest disappointment, though, was that 3D graphics drivers weren't available in time for this review. With the right drivers, it should be possible, at least in theory, to play most games in stereoscopic 3D. However, the included Nvidia GeForce GT 540M with 1024MB GDDR3 doesn't deliver cutting-edge gaming graphics. In our benchmarks, its frame rates were well below those of our zero-point gaming notebook. Even if the drivers worked, stereo 3D would cut that frame rate in half, since each frame would need to be rendered twice—making it even slower.

In our content creation benchmarks, the Qosmio F755 performed well, with the help of its 2GHz Intel Core i7-2630QM processor, 6GB DDR3/1333 memory, and 750GB, 5,400rpm hard drive. We were also pleased to see a rewritable Blu-ray drive; that's a technology that should be included on every system.

With its power supply, the notebook weighs more than eight and a half pounds; that's quite heavy for a device that only has a 15.6-inch display. The system lasted a respectable 102 minutes in our battery drain test.

Toshiba's put together a technological marvel with the Qosmio, and its bright-red chassis looks pretty slick, too. We're not sure, though, if the high price is justified by the limited utility. As of now, it's only good for watching 3D Blu-ray movies, and the lenticular display has some obvious downsides. At this point, if you're looking for a 3D laptop, you're better off putting vanity aside and donning on a pair of 3D glasses.

–KEN FEINSTEIN

**VERDICT 5**

**Toshiba Qosmio F755**

**+ SPLITTING THE BILL** Impressive glasses-free stereoscopic 3D effect.

**– SPLITTING HEADACHE** Mediocre 3D graphics performance; stereoscopic drivers not finished at time of testing; heavy.

$1,700, www.toshiba.com

### BENCHMARKS

| | ZERO-POINT | |
|---|---|---|
| Premiere Pro CS3 (sec) | 899.0 | 660 |
| Photoshop CS3 (sec) | 131.0 | 104 |
| ProShow Producer (sec) | 876.0 | 724 |
| MainConcept (sec) | 1,782.0 | 1,594 |
| Far Cry 2 (fps) | 48.5 | 23.9 (-50.7%) |
| Call of Duty 4 (fps) | 62.2 | 35.2 (-43.4%) |
| Battery Life (min) | 96.0 | 112 |

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero point notebook is an Asus G73Jw-A1 with a 1.73GHz Intel Core i7-740QM, 8GB DDR3/1066, two 500GB Seagate 7,200rpm hard drives, a GeForce GTX 460M, and Windows 7 Home Premium 64-bit. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

### SPECIFICATIONS

| | |
|---|---|
| CPU | 2GHz Intel Core i7-2630QM |
| RAM | 6GB DDR3/1333 |
| Chipset | Intel HM65 Express |
| Drives | 750GB 5,400rpm SATA hard drive |
| Optical | Blu-ray burner |
| GPU | Nvidia GeForce GT 540M with 1,024MB GDDR3 |
| Connectivity | HDMI out, VGA out, Ethernet, one USB 3.0, three USB 2.0, Wi-Fi, headphone, mic, line in, media reader, webcam |
| Lap/Carry | 7 lbs, 8 oz / 8 lbs, 11 oz |




Measuring 7.7x4.6x0.5 inches and weighing 14.5 ounces, the Acer A100 isn't the sleekest 7-inch tablet, but in some ways it's preferable to a 10-inch tablet.

# Acer Iconia Tab A100

## Cut yourself a li'l slab o' Honeycomb

**A SLEW OF HARDWARE MAKERS** that didn't start out as online bookstores—including Acer, Samsung, and Toshiba—debuted 7-inch Android Honeycomb tablets just in time for Amazon's Kindle Fire to steal their thunder. The apparent goal: to discover if anyone is actually interested in 7-inch tablets. Acer's Iconia Tab A100 serves as our guinea pig for this form factor.

Like most Honeycomb tablets to date, the Iconia A100 is based on Nvidia's 1GHz dual-core Tegra 2 processor, coupled with GeForce graphics and 1GB RAM. The multitouch LCD retains the 16:9 aspect ratio that other Android tablets use, but in WXGA HD resolution (1024x600). The Iconia A100's display exhibits excellent black levels and pleasantly accurate color and detail, but it's not nearly as lusciously detailed and vibrant as the Asus Eee Pad Slider.

With its ample CPU and graphics power, the Iconia A100 measures up to other top-performing slates in terms of screen swipes and redraws. We did, however, detect an ever-so-slight latency in its touch-screen responsiveness as compared to other tablets. Processor-hungry games such as Pinball HD and Sprinkle looked great on the Iconia A100, and gameplay didn't suffer at all from the smaller screen.

In fact, we preferred the smaller form factor for gaming because it's easier to hold and touch any area on the screen. This size also beats 10-inch tablets for reading e-books, for thumb typing (in both portrait and landscape modes), and for freaking people out by holding it up to your ear and pretending it's a phone. We've seen sleeker slates, though; the A100 feels a tad bulky, and Samsung and Toshiba have sexier models on offer.

The Iconia A100's 2-megapixel front-facing webcam and 5-megapixel rear camera (with autofocus, zoom, and LED flash) don't produce stunning photos: The images we captured exhibited considerable noise and color distortion, as is common with tablet cams. We did appreciate its camera options, including Honeycomb's standard Movie Studio video-editing app, and the 720p camcorder mode's time-lapse options (although you must place the tablet on a stand to make proper use of it). Connect the tablet to an HDTV or video projector using its Micro HDMI port, and you can play movies and slideshows on the big screen.

Acer is stingy with memory, equipping the Iconia A100 with just 8GB of storage, so we were happy to see that it has a microSD slot capable of supporting memory cards with up to 32GB of capacity. You can also shuttle files to and from a PC via the Micro USB port or by using Acer Sync, a PC app for managing contacts, calendars, photos, and videos. Acer's Media Server can stream media to any UPnP device on your network.

One thing the Iconia A100's Micro USB port cannot do is charge the tablet's battery; you must use the provided AC adapter for this. This limitation considerably hampers its portability, and Acer has informed us its next 7-inch tablet won't have this problem. Charging the tablet from 0 to 100 percent takes only about two hours, but the fairly skimpy 1530mAh battery is smaller than what you'll find in many smartphones. As such, an evening Netflix binge at full brightness consumed a full battery charge in about four hours.

Supreme portability and superior e-book-reading and thumb-typing experiences render the 7-inch form factor a viable proposition. While whiz-bang features and a low price ($200) will steer some toward the Kindle Fire, that upstart relies on a severely limited and customized flavor of Android. The Iconia A100 doesn't have the hottest looks or tip-toppiest features, but it's less expensive than most. –MARKKUS ROVITO

**VERDICT 7**

**Acer Iconia Tab A100**

**+ ICONIC** High-performance CPU and GPU; hardware screen-lock switch; Micro HDMI out.

**– ZIRCONIA** No power-charging over USB; small 1530mAh battery; lackluster photo image quality.

$330, www.acer.com

### SPECIFICATIONS

| | |
|---|---|
| **Operating System** | Android 3.2 (Honeycomb) |
| **Processor** | 1GHz dual-core Nvidia Tegra 2 |
| **Memory** | 1GB |
| **Storage** | 8GB (supports microSD cards up to 32GB) |
| **Cameras** | 2MP front, 5MP rear (with autofocus and LED flash) |
| **Connectivity** | IEEE 802.11b/g/n, Bluetooth 2.1 |
| **Weight** | 14.5 ounces |
| **Dimensions (WxHxD)** | 7.7x4.6x0.5 inches |

# Netgear WNDR4500 Wi-Fi Router

## At long last, a router to get excited about




Netgear wants consumers to keep the WNDR4500 vertical: The router comes mounted to its base with screws.

**IT'S EASY TO BECOME JADED** when you review as much cutting-edge hardware as we do. We try not to be curmudgeons, but we do get grumpy when next-gen hardware fails to make a leap in performance—or worse, when it falls behind the gear it's intended to supplant. So we're happy to report that benchmarking Netgear's new WNDR4500 left us grinning from ear to ear. This is the fastest router we've ever tested, and it's packed with new features.

Netgear continues to brand its wireless routers with two different model numbers. The WNDR4500, for example, is also marketed as the N900, presumably because this is a dual-band model that's capable of supporting three 150Mb/s spatial streams on both its 2.4- and 5GHz radios: Three times 150 equals 450, and 450 times two equal 900. That's nonsense, of course, because the two radios can't be bonded to serve a single client. It's also unfortunate, because this router is so fabulous it doesn't need to be hyped.

The WNDR4500 is dramatically faster than the older WNDR3700, which supports only two spatial streams on each of its frequency bands. At close range, the WNDR4500 achieved TCP throughput of 151Mb/s on its 2.4GHz radio, and a staggering 251Mb/s on its 5GHz radio. Compare that to the WNDR3700's 84.3Mb/s and 175Mb/s performance, respectively. The new router beat the old by a wide margin at every test location with the notable exception of our media room, where the WNDR3700's 5GHz radio beat the WNDR4500's by 27 percent. Interestingly enough, the WNDR3700's hardwired switch also proved to be slightly faster than the one on the WNDR4500, with the old router outperforming the new by 11Mb/s (887Mb/s versus 876Mb/s).

The WNDR4500 is the first router we've seen to boast USB 3.0 ports (two, to support both a storage device and a multifunction printer). This is a long overdue development, but we encountered a curious anomaly when we performed our NAS benchmark test, using a 500GB Western Digital My Passport USB 3.0 drive: The WNDR4500 was more than twice as fast as the WNDR3700 when writing files *to* the portable drive, but the WNDR3700 was significantly faster when reading files *from* it.

Netgear has completely revamped the router's browser-based user interface, although you won't need to access it right away: The default SSID for the 2.4GHz radio and a unique, but easy-to-remember password for both radios (ours was "magicalfire673") are printed right on the side of the device. Simply add "-5G" to access the 5GHz network. You're free to change any of the SSIDs or passwords, of course. You can also operate password-optional guest networks on both radios, with the ability to restrict guests to Internet access only, access to the Internet and other clients on the same SSID, or access to your entire network.

Netgear has come up with a free newb-friendly client app called Netgear Genie that's very similar in functionality to Cisco's Network Magic. You can control most aspects of the router's settings with this tool, display network maps, establish parental controls (administered via OpenDNS), monitor your bandwidth consumption, and more.

Aside from the oddly slow USB read performance—and the absurd "900" branding—we can't find a single flaw in the WNDR4500. If you have the budget, this is the router to buy. –**MICHAEL BROWN**

**VERDICT 9 KICK ASS!**

**Netgear WNDR4500 Wi-Fi Router**

**WONDER** Exceedingly fast; dual USB 3.0 ports; DLNA certified.

**BLUNDER** Slower than WNDR3700 when reading files from attached USB hard drive.

$180, www.netgear.com

### BENCHMARKS: WIRELESS

| | 2.4GHz Band | | 5GHz Band | |
|---|---|---|---|---|
| | Netgear WNDR4500 | Netgear WNDR3700 | Netgear WNDR4500 | Netgear WNDR3700 |
| Bedroom 1, 10 feet (Mb/s) | **151** | 84.3 | **251** | 175 |
| Kitchen, 20 feet (Mb/s) | **139** | 80.2 | **177** | 107 |
| Patio, 38 feet (Mb/s) | **90.4** | 69.5 | **63.5** | 48.7 |
| Home Theater, 35 feet (Mb/s) | **72.3** | 41.6 | 17.1 | **23.4** |
| Outdoors, 85 feet (Mb/s) | **34.7** | 22.7 | N/C | N/C |

Best scores are bolded. TCP throughput measured using JPerf. NAS tests consisted of copying a single 2.79GB file and a folder comprised of 659MB worth of files and folders to and from a USB 3.0 drive attached to the router. N/C indicates no connection at that location. Additional benchmarking methodology at bit.ly/r5USfh.

### BENCHMARKS: WIRED

| | Netgear WNDR4500 | Netgear WNDR3700 |
|---|---|---|
| TCP Throughput (Mb/s) | 876 | **887** |
| PC to NAS, small (sec) | **126** | 277 |
| PC to NAS, large (sec) | **332** | 883 |
| NAS to PC, small (sec) | 107 | **64** |
| NAS to PC, large (sec) | 422 | **258** |

# Clash of the Liquid Coolers

## Return of the double-double radiators

**YOU INSTALL AN ALL-IN-ONE** liquid cooler for one of two reasons: You either intend to run your CPU at stock speeds and want a whisper-quiet system, or you're overclocking and wish to keep your CPU cooler than it would be on just air. We put the Antec Kühler 920 and Corsair H80 liquid coolers—the double-thick, double-fan successors to the liquid coolers we reviewed in May—inside our extra-hot, overclocked test bed to see which would whimper first. –**NATHAN EDWARDS**

### ANTEC KÜHLER H2O 920 COOLER

The Antec Kühler H2O 920 is nearly identical to its predecessor, the H2O 620, but the new device has a thicker radiator (1.9 inches, compared to the 1.1-inch device on the earlier model) and two 12cm PWM fans that connect to the pump unit via a Y-splitter. The pump unit plugs into half of an internal USB header for software control, and it contains a color-customizable Antec logo. (Sadly, though, it doesn't seem to change color to indicate the temperature of the liquid).

The 920's install process is the same as before: You mount a backplate, install the first fan and radiator, clamp down the heat exchanger with the mounting plate, and install the secondary fan. Antec recommends that the fans be set up in an exhaust pattern.

The 920's settings are accessed via the bundled ChillControl software, which shows fan and pump speeds, liquid (not CPU) temperature, and decibel level. There are three settings: Extreme, which runs the fans at their maximum speed; Silent, which runs them at their lowest; and Custom, which lets you pick the temperatures at which the fans start to ramp up and hit their peak.

In Silent mode on our overclocked Core i7-930 (3.9GHz), the 920's fans were, in fact, nearly silent. CPU temps averaged 50 C after an hour of idling, and 75 C after an hour-long stress test. That's cooler at full load than the Corsair H70, the Kühler H2O 620, and the Prolimatech Armageddon—although each of those coolers beat the 920 at idle by 7–10 C. Setting the Kühler 920 to its Extreme setting dropped burn temperatures by an additional 5 C, but the 920's fans are simply too loud to use at full bore.

This puts us in a difficult position. We like the software controls, but they require the use of an internal USB header. The 920's Silent setting offers decent cooling for high overclocks, but its idle temperatures are too high. And switching to its Extreme setting is far too loud. The Custom setting shows promise, but at best you get performance somewhere between the other two settings. The 920 is a good choice if you're running a stock or slightly overclocked CPU, but only if you don't mind higher-than-normal idle temperatures. The Prolimatech Armageddon, with two 14cm fans, is very nearly as quiet, with better idle temps, and a much lower price tag of $90.

**VERDICT 7**

**Antec Kühler H2O 920 Cooler**

$120, www.antec.com




**Thanks to its USB connectivity, the Antec Kühler 920 is one of the few coolers that requires a hardware driver.**

## CORSAIR HYDRO SERIES H80 COOLER

Corsair's H80 is to its H60 as the H70 was to the H50, or Antec's H2O 920 is to its 620—it's the beefed-up version of a successful liquid cooler. In this case, Corsair has bumped the radiator to 1.5 inches thick, designed both 12cm fans to plug directly into the pump/heat exchanger unit, and added a three-speed manual control to the top of the pump.

Corsair's installation process is far superior to Antec's: Simply install a backplate, add four thumbscrew spacers, lower the head unit onto them, and secure with four nuts. It's less finicky and prone to breakage than Antec's cooler, and it feels more solid. Corsair recommends that you install the fans as intake, rather than exhaust. The H80 also includes an input plug for Corsair's upcoming Link control system, which will enable you to control the H80, as well as the rest of your case's fans and lighting, via a software interface—something Antec provides right out of the box.

The H80 underwhelmed us at its lowest manual setting. At full load on our overclocked system, it performed about the same as Antec's older Kühler H2O 620, although it was much quieter. At medium, however, the H80 was cooler *and* quieter than the Kühler 920—by a couple degrees at burn and nearly 8 C at idle. At its highest setting, the H80 cooled our CPU to around 73 C—that's 2 C warmer than the Kühler 920, but the H80 was a lot quieter.

For a stock-clocked rig, you need never go above the lowest setting with the H80 to have a cool and quiet machine. In an overclocked rig, the H80's medium setting hits the noise/cooling sweet spot. If you think you'll invest in the Corsair Link system, or if you like the near silence of liquid cooling on a stock rig, the H80 is for you. It's slightly cheaper than the 920, it's easier to install, and it doesn't take up an internal USB header. We'd still go for a big-ass air cooler like the Prolimatech Armageddon, though; it's cheaper and just as effective, even at über-overclocks.

**VERDICT** 8

**Corsair Hydro Series H80 Cooler**

$110, www.corsair.com

### BENCHMARKS

| | Corsair H80 (high / med / low) | Antec Kühler H20 920 (Extreme / Custom / Silent) | Antec Kühler H2O 620 | Corsair H70 (high /low) | Prolimatech Armageddon |
|---|---|---|---|---|---|
| Ambient (C) | 23.1 | 23.5 | 23.4 | 23.2 | 23.1 |
| Idle (C) | 41 / 40.75 / 43.75 | 48.25 / 50.5 / 50.75 | 43.75 | **40.5 / 40.75** | 41.25 |
| 100% Burn (C) | 72.75 / **74.75** / 80.75 | **70.5** / 76.5 / 75.5 | 79.5 | 76 / 78 | 75.75 |

Best scores are bolded. Ambient represents ambient air temperature in the Lab at time of testing. All coolers tested with a Core i7-930 overclocked to 3.9GHz on an Asus P6X58D Premium motherboard in a Corsair 800D chassis with stock fan, 6GB DDR3 RAM, and a Radeon HD 5850 GPU. Clock frequencies measured with TMonitor; temps with HWMonitor. Stress tests performed with Intel's internal testing utility running at 80 percent load. Ambient air temperature 23 C.




**Corsair's Hydro H80 is slimmer and quieter than the Kühler 920, if not actually cooler.**

# Rage

## Fast, frantic, fun... forgettable?




Rage, rage against the dying of the... well, just against the dying.

**BEFORE RAGE WAS RELEASED** there were a lot of unanswered questions floating around. Could Id make another genre-defining shooter? Would the six-plus years of development and the much-touted Id Tech 5 engine yield a sufficiently impressive result? While these are certainly appropriate questions for both reviewers and gamers to be curious about, we found ourselves haunted by another, seemingly trivial, question: What does the title Rage mean? Only after playing completely through could we truly understand.

Rage pulls off an impressive feat: It manages to have a lot of personality despite having minimal character. While you may not care about the paper-thin story or remember any character names, you'll probably notice something unique in just about every NPC—the grizzled-yet-vaguely lonely face of the mute knife mini-game guy, the windstick girl's exuberantly animated hand gestures and bubbly voice, the too-cool-for-school posturing of the town tough guy as he leans against a wall. The devil is in the details, and Rage gets the details right.

This subtle depth is mirrored in Rage's gameplay. First off, the weapons "feel right." The shotgun has just the right amount of spread, kickback, and stopping power. The assault rifle strikes the perfect balance between rate of fire and recoil. What's more, the game manages to keep every weapon useful and relevant throughout by providing numerous alternate ammo types. You can transform your humble pistol into a mighty magnum or miniature sniper rifle with the right rounds, or even change your crossbow from a silent killer to a mind control device.

Rage's visuals have an equal amount of depth, but nothing there is subtle. The Id Tech 5 engine is on full display, providing a smooth frame rate while maintaining a stunningly high level of detail and draw distance in its lovingly crafted environments.

These environments are further enhanced by how the enemies interact with them. Not content to simply duck behind cover, enemies will move around in truly organic fashion—hopping off walls, vaulting over debris, clambering along pipes, and hanging from guard rails. These fully articulated animations meld seamlessly with the game's damage and physics engines to create a real sense of weight, inertia, and natural motion as enemies juke, stumble, and flip back in reaction to your shots.

That's not to say the game isn't without some stumbles of its own. Rage uses an extremely nonintuitive keyboard/mouse control setup. Toggling between weapons is simple enough, but trying to switch ammo types or assign quick-use items is a bit of a chore, and clearly designed with controllers in mind.

The game's driving portions, while technically proficient, feel like little more than filler material between missions. Worse, the world you drive through is just open enough to make you want to explore it, but not big or fleshed-out enough to actually support that. By the time we'd finished the game (about 12 hours to do just about everything the game had to offer), we had little desire to jump into the driving battle rallies that serve as the game's only competitive multiplayer options.

So, what then does the game's name mean? Absolutely nothing. Then why "Rage"? Well, it's short, it's snappy, it's angry, but most importantly, it just looks and sounds cool. And that's exactly what Rage the game is about: It's about looking and sounding cool; it's about headshots, driving fast, and blowing stuff up. And while it might feel shallow at times, this rule-of-cool philosophy permeates every aspect of Rage's design—from the fast, flashy gunplay, to the lavishly animated enemies, to the ludicrously detailed environments. The result is a game that's fun as hell but probably won't leave a lasting impression on either gamers or the shooter genre. –DAN SCHARFF



Driving shows off the great-looking environment but gets stale by game's end.

**VERDICT 8**

**Rage**

+ **DOOM 2** Gorgeous, richly detailed world; buttery-smooth enemy and NPC animation; fun, satisfying shooting; weapons feel "right."

− **DOOM 3** Driving gets stale; controls not optimized for keyboard/mouse; not much to do in "open" world.

$60, www.rage.com

# LAB NOTES

NATHAN EDWARDS **SENIOR ASSOCIATE EDITOR**



# Doubling Down on Builds

I built two very difficult rigs this month, and learned important things from both

**THIS WAS A BIG MONTH** for me, as I got to do two build stories in the same issue: the Battlefield 3 rig (page 42) and the Windows Home Server box that Reviews Editor Mike Brown and I put together (page 70). These are two very different builds! The Battlefield build was more challenging, as I had to test a whole passel of different GPU configurations and beta drivers. In the end I achieved two things: I got a rig that can play Battlefield 3 on Ultra settings at 1920x1200 for not a whole lot of cash, and I changed my mind about modern multiplayer shooters. I normally prefer long, first-person, shooty RPGs like Fallout 3 and Deus Ex, but Battlefield 3 is addictive and fun. I rued the day the open beta ended.

The WHS build reminded me of an important fact: Windows install discs are insanely picky about burn speeds. After three hours of swapping parts trying to figure out why the OS wouldn't install, I re-burned the WHS 2011 .iso at a slower speed, and the problem went away. Damn you, generic hardware error!






Katherine Stevenson
**Editor-in-Chief**

This month's Tech Preview had me contemplating Ultrabooks and Intel's positioning of them as competitors to tablets. While budget ultraportables have the potential to make a big splash next year—à la the netbooks of yore—I just don't see them actually toppling tablets. I think they represent two very different use cases. Just my opinion.



Amber Bouman
**Online Features Editor**

It's probably sacrilege to admit this, but I'm looking forward to getting my hands on an iPhone 4S. My poor old iPhone 3G is laggy, crashy, and barely usable at this point so *any* handset would be an improvement, but this marks the first time I could be considered an "early adopter." I'm still deliberating over a Windows Phone 7 switch, so we'll see how well the 4S works out for me.



Alan Fackler
**Online Associate Editor**

Battlefield 3? Shrug. I'm looking forward to Arkham City, and the fact that we've got to wait an additional month to get it kills me a little inside. I have been browsing the Lab for an Nvidia GPU to swap out for my Radeon HD 5970—I hear enabling PhysX in Arkham City is the only way to truly max it out. Blam! Kerplow!



Markkus Rovito
**Senior Editor**

This was the month of going offline. No, I didn't give up Internet as a masochistic experiment in austerity. Rather, I enabled Google Cal's offline features (free), and upgraded to Evernote Premium ($45 a year) for its offline notebooks and Rdio Unlimited ($10 a month) for its offline music syncing. Less sweating over cell signals and data caps: good! Disconnection never felt so liberating.



Gordon Mah Ung
**Deputy Editor**

One underrated feature of Sandy Bridge-E is the ability to add insane amounts of RAM for very little money. As Asus points out: 32GB on a Sandy Bridge system (if you can even find 8GB unbuffered DIMMS) is at least $800. On Sandy Bridge-E, though, you can run 32GB for $200. Now to find a use for all that memory.

# LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

## > Custom ROMs for Android
## > Chromebook Criticism
## > The Definition of SAS

### Custom ROMs can Smooth out Android

Regarding the editor's letter in the December issue ("Gordon Goes to Apple"), as I understand it, your experience with the Android OS was soured by slight interruptions of smoothness and responsiveness when multitasking with the Samsung Galaxy Tab 10.1. I understand that modding/rooting your shiny new Galaxy tab can void its warranty, but some of the modded ROMs available have something to offer in return. Since Android tablets have been released, many talented developers have been customizing ROMs/OS to combat just what you experienced. And I think some of them have come a long way since their launch.

My question is, was the tablet you tested running the stock OS, an update, or a modded kernel/ROM? Figured I'd ask, as it is *Maximum PC*, and you are all about maximizing one's experience with tech! Overall, I enjoyed the December issue, and thank you for all your reviews on the tablets ("Tackling the Tablet Conundrum"). I'm in the market, and it helps me make an informed decision about which one to choose.

**—George E. Collins Jr.**

**DEPUTY EDITOR GORDON MAH UNG RESPONDS:** My experience is with the Galaxy Tab 10.1 with the latest available updates from Samsung installed. Since it's a review unit and the property of Samsung, I'm reluctant to root it and run custom ROMs. I do run an Android HTC phone with a rooted ROM, and despite my phone being a little elderly, it is a satisfying experience. As much as a custom ROM might improve the smoothness of the interface, I'm sticking to my demands that Google and its hardware partners put more energy into interface smoothness if they expect to knock the iPad 2 from its perch, which I believe will actually happen.

### Too Nice to the Chromebook

The Samsung Series 5 3G Chromebook you reviewed (September 2011) cost $500 and received a 7 verdict. The HP dm1z, reviewed June 2011, cost $480 and scored a 9/Kick Ass rating. The HP is running AMD's awesome Fusion APU, 3GB of RAM, 320GB of storage, an LED-backlit 1366x768 screen, and Windows 7. It plays Quake 4, Half-Life 2, WoW, and L4D2 well, along with HD video. And having Windows, you can add advanced software that doesn't run on Chromebooks, Android books, or tablets—like real Microsoft Office, Visual Studio, Cygwin, Photoshop, etc. And the HP weighs just three pounds, seven ounces to the Chromebook's three pounds, four ounces.

The HP does everything the Chromebook does, but better, and more besides. And it does it for $20 cheaper! Even if you didn't need the power of the HP dm1z and the Chromebook was just $300, it still wouldn't be worth it. You can get netbooks running Windows 7 on Atom processors that do everything the Chromebook can do and more for the same price, but you get the freedom of Windows, Office, etc.

When you sell a device for $500, you're comparing it to everything else at that price point. For the Chromebook, the price/performance calculation is dangerously close to divide-by-zero.

**—Matthew Alpert**

**SENIOR ASSOCIATE EDITOR NATHAN EDWARDS RESPONDS:** I think I was pretty clear in my review that the Chromebook is not an ideal primary computer. If you have $500 to spend on your entire computing ecosystem, and you want a laptop, you should get something like the dm1z. The Chromebook is good for people who already have a primary computer for "real" work and want something quick and light they can take with them on the road. I actually prefer its lack of Windows; that's one fewer system I need to worry about keeping backed up and up-to-date. The Chromebook's near-instant resume, strong web hooks, and lightweight OS make it feel much faster than a Windows 7 netbook.

### $100 Windows? Where?

In September's $340 Ultra-Budget Box (Build It), the ingredients list had Windows 7 listed for $100. I went to Microsoft's website and the price was $199. How can I get it for $100?

**—Ed**

**SENIOR ASSOCIATE EDITOR NATHAN EDWARDS RESPONDS:** We get OEM versions of Windows

↘ submit your questions to: comments@maximumpc.com

7 from Newegg, where they're $100. OEM versions are slightly tricky because you might need to call Microsoft to renew your license if you swap out too many parts down the road, but we've never had a problem using them.

## Sassy Response

Just received the December issue and wanted to point out an issue with the X79 article on page 10 (Quick Start). SAS stands for Serial Attached SCSI, not SCSCI Attached SATA. Is the latter even possible?

**—Matt Frew**

**DEPUTY EDITOR GORDON MAH UNG RESPONDS:** I'm actually aware of this technology called SAS, which means Serial Attached SCSI, but it's boring, so I decided to invent my own technology, for which I broke the NDA on page 10 of the December issue. The new technology is "SCSCI Attached SATA." Incidentally, I've since obtained the patents and trademarks for SCSCI, and am now trying to figure out a technology that will fit the acronym. You see, instead of building technology and then creating an acronym, I am building an acronym first and the technology second. P.S.: The SAS support is officially gone from X79, so we're sad.

## Windows 7 as a Server

In looking for a good home server OS, I tried FreeNAS and Windows Home Server, and then I tried Windows 7. Hot-swappable drives seem unnecessary and RAID doesn't seem cost-effective or error-proof. For me, Win7 is a better solution for my project: a movie server. My box is low-budget and headless, with one hard drive for the system and four others for a 6TB dynamic drive. I have a virtually identical box providing backup for that box and the rest of my network using SyncToy. I use MyMovies to download movie covers, parental control, and other info, and to organize it all with a nice interface. I then play content through Windows Media Center on my TV. I ran into lots of problems with FreeNAS and Windows Home Server, but so far Win7 has worked great for over a year now.

This Windows 7 setup should have been the first thing I tried, but I'm curious: Why doesn't anyone talk about this straightforward, simple, and cost-effective solution? I've got to be missing something.

**—Randy Tholen**

**SENIOR ASSOCIATE EDITOR NATHAN EDWARDS RESPONDS:** Windows 7 might very well have been the best solution a year ago when you built your box. However, since then, Windows Home Server 2011 has been released, and I think that's a better solution. You don't need to use SyncToy, as it has robust server backup built in, and WHS2011 supports dynamic drives and MyMovies, as well. It's very similar in look and codebase to Windows 7, and it's a lot cheaper. So while Windows 7 might be a better home server solution than Windows Home Server 2008, I think that if you tried WHS2011 you might find it cheaper and easier. That said, if Win7's working great for you, awesome!

[NOW ONLINE]

## HARDWARE AS ART

Who says computer hardware has to be all function over form? We think that sometimes you should take a minute to appreciate the technological beauty inherent in your PC's power-chugging innards. That's what the artists behind the works of art in our most recent gallery have done, creating 25 gorgeous and surreal masterworks out of PCs, VCRs, CDs, and more: bit.ly/p21zet.



Image credit: Theo Kemecke.

[NEXT MONTH]

COMING IN MAXIMUM PC'S THIS SPACE FOR RENT JANUARY ISSUE

### How to Christen a New PC

So you got a new rig for the holidays. We'll outline everything you should do to break it in—from checking the hardware, to tweaking the settings, to installing critical utilities, to establishing maintenance routines.

### The PC Gaming Renaissance

It's a great time to be a PC gamer. The hardware is better than ever, and there's a host of hot new games coming out that cater to our platform of choice. Next month, we revel in PC-gaming glory!

### In Search of the Media Suite Spot

We'll round up three do-everything media packages and put them to the test to find the ultimate music, movie, and photo wizard.

# HARDWARE




## THE REST OF THE BEST

**Midrange Processor**
Intel 3.4GHz Core i7-2600K
www.intel.com

**Budget Processor**
Intel 3.3GHz Core i5-2500K
www.intel.com

**LGA1155 Motherboard**
Asus P8Z68-V Pro
www.asus.com

**AM3 Motherboard**
Asus M5A99X Evo
www.asus.com

**Price-No-Object GPU**
Asus GeForce GTX 590
www.asus.com

**Performance GPU**
XFX Radeon HD 6970
www.xfxforce.com

**Midrange GPU**
MSI NGTX560 Ti Twin Frozr OC
www.msi.com

**Budget GPU**
XFX Radeon HD 6870
www.xfxforce.com

**Performance Hard Drive**
OCZ Vertex 3 256GB
www.ocztechnology.com

**Capacity Hard Drive**
Hitachi Deskstar 7K3000 3TB
www.hitachigst.com

**Air Cooling**
Cooler Master Hyper 212 Plus
www.coolermaster.com

**High-End Cooler**
Prolimatech Armageddon
www.prolimatech.com

**Blu-ray Drive**
Plextor B940SA
www.plextor.com

**Full-Tower Case**
Corsair 800D
www.corsair.com

**Mid-Tower Case**
Corsair White Graphite Series 600T
www.corsair.com

**Midrange Display**
LG E2370v
www.lg.com

**Router**
Netgear WNDR4500
www.netgear.com

For even more Best of the Best entries, such as speakers and more budget components, go to www.maximumpc.com/best-of-the-best.

### HIGH-END PROCESSOR

## Intel 3.3GHz Core i7-3960X

Intel's Core i7-3960X is like a Reese's Peanut Butter Cup of goodness—combining the two great tastes of Sandy Bridge and Gulftown. It's the fastest CPU that's ever blown through our benchmarks. Yup. It *screams*. That's not to mention the insane amounts of memory bandwidth and tons of PCIe 3.0 lanes that it supports. To use another food metaphor, the Core i7-3960X isn't just red meat for performance enthusiasts—it's a prime rib topped with a New York strip steak, followed by a Kobe beef chaser. Well done. www.intel.com



## GAMES WE ARE PLAYING

**Battlefield 3**
www.battlefield.com

**Minecraft 1.8**
www.minecraft.net

**Deus Ex: Human Revolution**
www.deusex.com

**Team Fortress 2**
www.teamfortress.com

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